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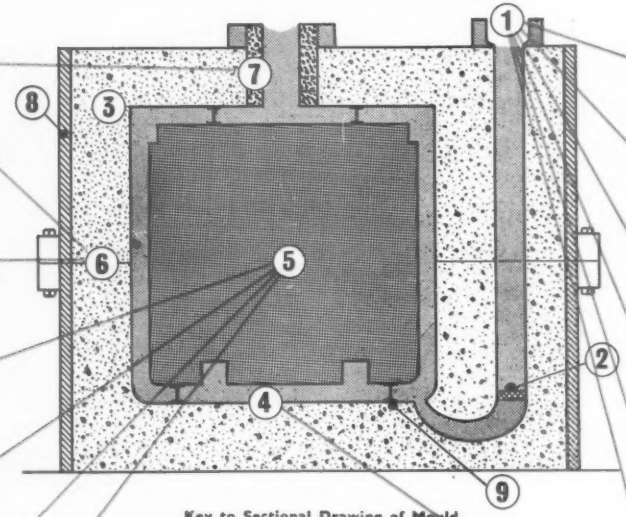

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PRINCIPAL CONTENTS

PAGE

Refractory Concrete in Foundries

By E. Hammond, B.Sc., Ph.D., A.R.I.C., M.Inst.F.

In the second, and concluding, part of the paper published this week, the Author deals with the advantages of castable refractories in the construction of electric, arc, fuel-fired and reverberatory furnaces .. 203

Desirable Properties of Cupola Coke

Report of technical sub-committee, T.S.47, of the Institute of British Foundrymen 211

Australian Symposium on Foundry Coke

Synopses are given of two papers presented at a two-day symposium on foundry coke, held recently in Australia 215

Institute of Vitreous Enamellers' celebrate their Silver Jubilee with a Conference and Exhibition in London 219

Le Ciment réfractaire dans les Fonderies. Par E. Hammond, B.Sc., Ph.D., A.R.I.C. M.Inst.F. 203

Propriétés requises pour le Coke destiné aux Cubilots. Rapport du comité technique, T.S.47 de l'Institute of British Foundrymen. 211

Symposium Australien sur le Coke de Fonderie. Des résumés sont donnés des deux mémoires présentés à un symposium d'une durée de deux jours, sur le coke de fonderie, tenu récemment en Australie. 215

Feuerfester Zement in Giessereien. Von E. Hammond, B.Sc., Ph.D., A.R.I.C., M.Inst.F. 203

Wünschenswerte Eigenschaften von Kupolofenkoks. Ein Bericht des technischen Ausschusses T.S.47 des Institute of British Foundrymen. 211

Ein Australisches Symposium über Giessereikoks. Es werden Kurzauszüge aus zwei Vorträgen gegeben, welche auf dem kürzlich in Australien stattgefundenen zweitägigen Symposium über Giessereikoks gehalten wurden. 215

Features, News, Commercial Information and Statistics

Leader: Foundry Coke 201
International Die-casting Conference 202
Institute of Vitreous Enamellers—Annual School 202
Symposium on Pilot Plants 202
Forthcoming Events 202
Equipment and Supplies 214
BISF Management College 218
American Letter 221
British Blast Furnaces in the June Quarter, 1959 222
Castings for USA 222
BCIRA Lectures 223
Progress in training Technologists 223
News in Brief 224
Raw Material Markets 228
Current Prices of Iron, Steel and Non-ferrous Metals 230
Notes from the Branches 232
Company News 234
Pig-iron and Steel Production 236

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FOUNDRY
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Foundry Coke

This commodity is of basic importance to the ironfoundry industry, but compared with pig-iron, its technical sales conditions lag woefully behind. The last three decades have seen many changes in the conditions of sale of pig-iron, involving the replacement of just numbers by chemical composition and, in most cases, machine-cast pig has replaced the sand-cast variety. Meanwhile, the quality of foundry coke has been stationary where, in fact, it has not deteriorated. Mr. L. W. Bolton in introducing a report on the subject to the annual meeting of the Institute of British Foundrymen,* placed consistency of properties spread over the year's deliveries as being of major importance. He also stressed the importance of shatter tests. During a session at the Management Training College at Ashorne Hill, organized by the British Iron and Steel Federation, it was reported that considerable capital expenditure in a scheme for hypothetical blast-furnace plant would be saved if there were insistence that the coke-oven manager should supply a product with a 90 shatter index. It would result in so much less coke being used that fewer coke ovens would need to be installed. Moreover, the speaker, Mr. W. Hunter, was speaking from practical experience. It appears that by intelligent blending of coking coals a quality of coke of this order can be achieved.

Elsewhere in this issue, is printed an Australian report of important full-scale (500 tons) tests on Densite or high-carbon coke. It was a pity in that case that a changeover to hot-blast caused the discontinuance of the tests, as they appeared to be very promising. The increased rate of production of liquid iron which was noted could in some cases be a valuable asset to a foundry. At least the coke seems to have the virtue of being consistent in quality.

A final step the foundry industry could take is to request the British Standards Institution to form a committee to ascertain whether sufficient information is available (or could be readily obtained) to formulate a quality specification for foundry coke. Should this be forthcoming, it should go far to implement Mr. Bolton's first requirement as to consistency, for it is well known that throughout the world good iron castings are made with coke having ash contents of anything between seven and 25 per cent. ash. In committee, the question of the imposition of the shatter test as a criterion of quality could be properly ventilated.

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* See page 211 of this JOURNAL.

International Die-casting Conference

The third international Pressure-die-casting Conference is being organized for the European Pressure Die Casting Committee by the Italian member of the secretariat, the *Istituto Italiano del Piombo e dello Zinco*, with the help of the pressure-die-casting section of Assomet (the National Association of Non-Ferrous Metal Industries).

This conference, to be held at Stresa on Lake Maggiore from May 16 to 20, 1960, is expected to have an even greater success than the second in the series which was held in Paris in 1957, and which was attended by over 300 delegates from 15 countries. Interest in die-casting and its applications is constantly growing, and added attractions at the 1960 conference will include displays of the world's leading die-casting machine makers and an exhibition of European castings in zinc, aluminium and magnesium alloys. A large American attendance is expected as both the American Die Casting Institute, which is sponsoring two papers, and the American Society for Die Casting Engineers are planning to send official teams.

Preliminary Programme

The preliminary programme for the conference shows that, as before, two days will be devoted to technical sessions and two days to works visits. Fewer papers will be given at this conference (twelve instead of sixteen) and ample time will be reserved for discussions on each paper. A "question and answer" session is to be held on the second afternoon. The papers, all of which have been specially invited by the European Committee, will be sent out about a month before the conference to those who enrol. They will be available in French, German and Italian as well as English, the four official languages, which will be used at the meetings, through the medium of a simultaneous translation service.

The works visits will give delegates the opportunity of seeing at least two plants in northern Italy, —those of a large trade die-caster and a "captive" die-casting plant. The latter visit will be to an internationally-known firm, such as Necchi or Olivetti.

Conference fees of 37,000 lire (£21 sterling) are payable in advance or on arrival at Stresa; ladies and other guests not taking part in the technical sessions or works visits may attend the social functions for a fee of 6,500 l (£4). Enrolment forms, preliminary programmes and descriptive leaflets about Stresa are obtainable from the Zinc Development Association, 34 Berkeley Square, London, W.1.

Symposium on Pilot Plants

With the intention of providing an international forum for the exchange of ideas on the development of pilot plants in metallurgical fields in India, the National Metallurgical Laboratory, Jamshedpur, India, has invited metallurgists and research scientists in India and abroad to participate in a symposium on "Pilot Plants in Metallurgical Research and Development" to be held in February 1960. The symposium will deal broadly with the following subjects as they relate to pilot-plant projects:—Laboratory scale investigations and industrial scale implementation; economics and production costs; existing plants in India; plants in other parts of the world; thermal and chemical beneficiation of low-grade ferrous and non-ferrous ores; pyro- and electro-metallurgical plants; new refractories; finishing of metals; and constructional materials.

Institute of Vitreous Enamellers

Annual School at Buxton

This year, the Institute of Vitreous Enamellers is holding its Annual School in Vitreous Enamelling at the Spa Hotel, Buxton, from October 9 to 11. The programme commences on the Friday, with an afternoon works visit to Leisure Kitchen Equipment, Limited, Long Eaton, delegates meeting at the Midland Hotel, Derby, for luncheon at 12 noon, before going on to Long Eaton. The party will return in time for dinner at 7 p.m. which will be followed by the first technical session at the Spa Hotel, with a lecture at 8 p.m. by Mr. C. S. Beers on "Quality Control."

Saturday's Programme

For Saturday, October 10, five technical sessions have been arranged, details of which are as follows:—*9.30 a.m.* "Preparation of Frit for Spraying or Dipping," by Mr. G. W. Ratcliffe. *2 p.m.* "Enamel Faults and their Analysis," by Mr. E. W. B. Dunning. *3 p.m.* "Diagnosis and Cure of Enamelling Faults," by Mr. D. Mill. Break for tea at 4 p.m. and then the last session at 4.30 p.m. the subject being "Aluminium for Enamelling and the Enamelling Thereon" by Dr. G. E. Gardam and Mr. A. Biddulph. Dinner at 7 p.m. will be followed by a talk by Dr. W. L. German, head of the College of Ceramics, North Staffordshire Technical College, on "Educational Facilities in the Industry." Delegates will disperse after breakfast on Sunday morning at 8 a.m.

The fee for attendance at the School, covering the works visit, meals, accommodation, gratuities, is £6 10s. 0d. per person. The event is organized by the secretary of the Institute, Mr. J. D. Gardom, from Ripley, Derbyshire.

Forthcoming Events

SEPTEMBER 28

Institution of Plant Engineers

West and East Yorkshire branch: "Operational Research," by G. D. Jordan, 7.30 p.m., at the Houldsworth School of Applied Science, Leeds University.

Association of Bronze & Brass Founders

Yorkshire area: Report and discussion of current activities, commencing 12.15 p.m., at the Great Northern Hotel, Leeds. Luncheon 1 p.m., after which Mr. W. H. Davies will talk about "Costing a Casting."

SEPTEMBER 29

Institute of British Foundrymen

Slough section: "Patternmaking in Plastics," by H. G. King, 7.30 p.m., in the Lecture Theatre, High Duty Alloys, Limited.

SEPTEMBER 30

Institution of Production Engineers

Shrewsbury section: "Uses and Developments of Work-study," by W. C. Castledine, 7.30 p.m., at Shrewsbury Technical College.

Loughborough College Student Section: Afternoon Visit to J. Lucas, Limited, 2 p.m., S. Block Restaurant, Farm Street, Hockley, Birmingham.

Association of Bronze & Brass Founders

Scotland: Meeting at the St. Enoch Hotel, Glasgow, commencing 12 noon for report and discussion of current activities. After luncheon, talk by Mr. W. H. Davies on "Costing a Casting."

OCTOBER 1

Institute of British Foundrymen

Stoke-on-Trent section: Presidential Address followed by "Moulding with the CO_2 Process in a Jobbing Foundry," by J. Hird, 7.30 p.m., at the Stipendiary Court Room, Town Hall, Hanley.

OCTOBER 14

Institute of British Foundrymen

Australia (Victoria) branch: "Brown Coal Char as a Fuel for Foundry Cupolas," by D. G. Evans, M.Sc., R. S. Higgins, M.Eng.Sc., and G. L. Kennedy, M.Sc. (Exchange paper to IBF conference, 1959). Meeting to be held at the Metallurgy Theatre, Royal Melbourne Technical College.

Refractory Concrete in Foundries

(Continued from page 178)

By E. Hammond, B.Sc., Ph.D., A.R.I.C., M.Inst.F.

In concluding last week's article, the author deals with the advantages of castable refractories in the construction of electric, arc, fuel-fired and reverberatory furnaces. Summing up, he notes that the greater proportion of refractory concretes employed in foundries are based on the well-known grey high-alumina cement, since most of the larger installations do not require parts made from high-duty refractories.

ELECTRIC FURNACES

The introduction of the pure t.c.p.a. cement has resulted in the increased use of castable refractories in electric furnaces—particularly in all types of melting furnaces where high refractoriness, slag resistance, and non-reactivity with the metal is required. In the latter case particularly, it is essential to use an aggregate which is also free from iron compounds, *e.g.* molochite (*i.e.* fired china-clay), sillimanite and fused alumina. Perhaps one of the main reasons for the increasing use of refractory concretes in electric melting furnaces is the ease of casting complicated linings—in many cases they are replacing ramming mixes, because the quality of the lining is not so sensitive to installation techniques as the rammed lining, and the latter has also to be carefully dried and sintered (a procedure which may take a matter of weeks).

Induction Furnaces

The main failures of refractory linings in the core-type mains-frequency furnace occur in the region of the slot or channel, and are usually due to excessive attack by the metal or metal oxide (which enlarges the slot and reduces the electrical efficiency of the furnace), or cracking of the slot (which permits seepage of the metal to the coil or shield and necessitates shut-down). In general, therefore, the lining should preferably be monolithic, "slag" resistant, and capable of withstanding steep temperature gradients. The latter property may be correlated with good thermal shock resistance. Rammed plastic refractory linings are used extensively, but the subsequent life of the lining is very dependent on the technique of ramming and the care taken in the very slow processes of drying-out and firing the lining[5]. It is mainly for this reason that refractory concretes are being increasingly used, particularly for the smaller furnaces, where efficient ramming is difficult since the times for casting and pre-heating the lining are, if necessary, only a matter of hours and days rather than days and weeks. Nevertheless, the success of a refractory-concrete lining is still very dependent on correct casting and pre-heating procedures.

The mix should be of the correct workability for good vibratory compaction. Although compaction by ramming tools is employed, the use of small poker vibrators (or vibrators attached to the rigid steel former) is preferable, and certainly more efficient and quicker than ramming, particularly for small complicated castings. The pre-heating schedule permissible with refractory-concrete linings is extremely rapid compared with rammed linings. There is, however, one small but very important precaution which should be observed when the metallic former of the slot is used for pre-heating the lining by induction under reduced power—this is that the metal former should be wrapped in a material such as braid to allow for its expansion. It is, of course, important in this operation not to melt the former, since this would break the circuit, but the temperature attained is sufficient to burn off the braid. This braid wrapping is particularly advisable with refractory concretes, since they possess a high unfired strength due to the hydraulic bond of the cement, and do not possess the same amount of compressibility as an unfired ramming mix (which only develops appreciable strength after firing). Without the braid, the expanding metal former may cause incipient cracks or weak zones which only become evident during service. This pre-heat method is adopted extremely successfully in the installation of the lining shown in Fig. 15, the furnace being then put immediately into normal operation. A mix of t.c.p.a. cement/sillimanite is employed, and the furnace is used for holding s.-g. iron at a temperature of about 1,550 deg. C. The slot temperature is quoted as being in the region of 1,700 deg. C. The lining life is approximately seven weeks, five times better than that of previous linings of a ramming mix based on fused alumina.

Refractory and insulating concretes have also been used for the lid and lining of a new twin-coil Tagliaferri mains-frequency induction furnace of capacity 25 cwt., used for melting s.-g. cast-iron. The lid of this furnace has been lined with approximately 4½ in. of a t.c.p.a. cement/sillimanite mix backed by 2½ in. of high-alumina cement/vermiculite insulating concrete, and is giving extremely good service, even after some extraordinary conditions imposed on it during the first few weeks of service. A t.c.p.a. cement/alumina mix was used for lining the hearth of the furnace, and for a 2-in. protecting layer around the two vertical water-cooled coils in the bath. The hearth lining was very successful, but the 2-in. layer around the coils did not frit sufficiently hard, probably due to the water-cooling (the mix employed was, if anything, too refractory for this particular location). In view of the good service obtained with the t.c.p.a. cement/sillimanite concrete in other types of electric furnaces melting

(*Courtesy: Hepworth & Grandage, Ltd.*)

FIG. 15.—*Refractory-concrete (t.c.p.a. cement/sillimanite) lining of an induction furnace used for holding s.-g. cast-iron.*

s.g. iron, this type of mix is to be used in the future.

Various types of aluminium-melting induction furnaces are also lined with refractory concrete, *e.g.* EFCO, AJAX, Brown-Boveri, B.O.R.A. and Stein and Roubaix. The t.c.p.a. cement is normally employed with various aggregates (*e.g.* chamotte, alumina, and possibly zircon and olivine). For instance, EFCO-Lindbergh twin-chamber furnaces have been lined with a proprietory premix believed to consist essentially of the t.c.p.a. cement and olivine (magnesium silicate). With this lining some trouble appears to have been experienced due to the reduction by the aluminium of the silicate in the mix, resulting in a deposition of a hard material (probably mainly alumina) in the slot. In one case, therefore, a change-over was made to a silica-free aggregate (fused alumina). A mix of 1 vol. t.c.p.a. cement : 3 vols. fused alumina was employed for both the pre-cast slot unit (which was pre-fired up to 1,350 deg. C.), and for the remainder of the lining, *i.e.* furnace chambers. The lining was cast *in-situ* and compacted by rodding, and vibrators attached to the metal formers. The latter were stripped after four hours, when the lining was water-cured for 24 hours. The pre-heating was by charcoal fires in the furnace chambers, which gradually raised the temperature to approximately 1,000 deg. C.

The possible reaction of molten aluminium with alumino-silicate aggregate is, however, obviously not considered very important by one large firm, who use a t.c.p.a. cement/chamotte mix for lining approximately twenty induction furnaces of various types. In this instance, the pre-heating of the lining is first by electric heating, which in four hours raised the temperature to 110 deg. C. and maintains it for a further hour. The temperature is then raised to 500 deg. C. in four hours by a gas flame, and, after another hour at 500 deg. C., the lining is finally rapidly heated to 1,200 deg. C. by the gas flame and maintained at this temperature for a further two or three hours.

Refractory concretes do not appear to have been considered very much for lining brass-melting induction furnaces. This may be due to the fact that no serious problems appear to exist here[6]. Recently, however, the bath of an 800-lb. Birlec mains-frequency furnace for melting brass was lined with ordinary refractory concrete (h.a. cement/crushed firebrick). The ramming mix previously employed was rather friable at the bath temperature of 900 to 1,000 deg. C. and, in view of this comparatively low temperature, the amount of cement in the mix was increased to a little more than normal. The installation time was approximately 2½ hours, as against two days for the ramming mix, and the cost of materials was also reduced by approximately 70 per cent. In the Birlec-type of furnace with a "rectangular slot," pre-cast units made with a mix of t.c.p.a. cement/molochite are used, *e.g.* plugs for the horizontal portion of the channel and dampers which are inserted in the bath to control the metal flow. The problem of a satisfactory refractory lining in induction furnaces appears to be most acute when melting copper or cupro-nickel alloys. Cracking due to the relatively high temperature, and slot erosion (mainly by manganese oxide), which attacks siliceous refractory compounds), are the main problems. In view of the latter, aggregates such as fused alumina, fused magnesia and calcined magnesite would seem to be promising, although ramming mixes incorporating these materials have not apparently come up to expectations[6]. Trials with a t.c.p.a. cement/fused alumina mix have been carried out in an experimental furnace. The lining failed due to one vertical crack above the slot, but this may have been due to faulty installation (*e.g.* no braid wrapping around the slot former). Opinions vary on the desirable characteristics of this type of furnace, and it is interesting to note that the normal expansion properties of castable refractories may be varied by suitable choice of aggregate, or by the use of small quantities of refractory additive (as previously mentioned).

Refractory concretes do not appear to have been used quite as much in coreless stoves (mains and high-frequency) as in the core type. This is possibly due to the fact that the installation of ramming mixes is somewhat easier due to the simpler shape of the lining. The installation is, however, much simpler with castable refractories, and various methods may be employed[7]. A typical example is shown in Fig. 16 for a furnace melting aluminium (a t.c.p.a. cement/fused alumina mix was employed). A similar mix has been used for the plinth supporting the coil, and the lining of the coil, of a high-frequency furnace melting

uranium in a graphite crucible. This mix is also employed for lining small high-frequency furnaces used in precision-casting shops, because of its higher refractoriness and non-reactive nature with the alloys. For similar reasons, presumably, mixes of magnesite with the t.c.p.a. cement have been used for lining vacuum-induction furnaces. In one instance, a mixture of this cement and a proprietary ramming mix (mainly calcined magnesite with a proportion of alumina) was employed for the head and roof of this type of furnace. In a patent[7] of EFCO, Limited (describing a unique method of installing refractory-concrete linings which seems particularly suitable for coreless furnaces), a mix of t.c.p.a. cement with alumina, magnesite or quartzite is suggested. The latter material is normally not recommended as a refractory-concrete aggregate because of its high expansion characteristics. Its suggested use in this case is presumably due to the nature of the linings, which, owing to the special method of installation, consist essentially of an internal skin of hardened concrete backed by a dry mixture of practically unhydrated cement and aggregate. In these circumstances, the high expansion of quartzite is probably of little consequence, at least in the unhydrated loose backing. The suggested mix proportions are 15 per cent. t.c.p.a. cement : 85 per cent. graded aggregate. After the dry mix has been rammed between the coil and the internal former, the latter is removed and the internal surface of the concrete sprayed with water. Alternatively, the former may be provided with holes, in which case its removal is not necessary before the water-spray is applied. Another method suggested is to line the former with an absorbent pad saturated with water, which hydrates the surface of the refractory-concrete mix while it is being rammed.

When castable refractories are used for the main lining of coreless induction furnaces melting high temperature metals, mixes incorporating the t.c.p.a. cement are more suitable. A proprietary castable refractory consisting essentially of h.a. cement/crushed firebrick is used for lining the top 9 in. of the lining of a Birlec 5-ton furnace melting s.-g. iron[8].

Arc Furnaces

As in other applications where refractories have to withstand very arduous conditions, major development of the use of castable refractories in arc-furnaces was not possible until the last few years, when the high-duty mixes incorporating t.c.p.a. cement became available. Both in this country and the USA, the main developments have been centred on the areas in the furnace where castable refractories have obvious advantages, such as the crown and the charging and slagging arches. Only very small arc-furnaces have so far been fitted with refractory-concrete crowns (about 3 ft. to 4 ft. in diameter). A typical example of a furnace melting steel is shown in Fig. 17, where a sillimanite aggregate was used. Foundries appear to normally use arc-furnaces of approximately 5 to 10 tons capacity, but it is interesting to note that, in large steel-making arc-furnaces of approximately 80 tons capacity (employing basic slagging practice and decarburization with oxygen lances) modern practice is to use castable refractories for casting round the individual electrode ports, or an area of approximately 6 ft. dia. at the centre of the crown which includes all three ports. According to McCullough[9], this type of crown increases the average roof life by about 30 per cent. (*e.g.* 60 to 80 heats). Since the cost of the roof (materials and labour) is said to be less than with a silica or super-duty firebrick, the cost of the roof per ton of steel is also reduced by up to 30 per cent. Similar trials with ramming mixes in the central area of the crown were not so successful, and failure of the rammed portions was apparently brought about by lamination tendencies, and progressive spalling off of layers which began after about 10 heats. In this connection it is interesting to note the importance the Author attaches to the compaction of the castable refractories by poker vibrators.

Encouraged by these results, the same type of refractory concrete was also used successfully for the skew-backs and the areas above them on the mast side, where failure of the silica brick was reducing roof life. Of the types of castable refractories investigated in arc-furnace crowns, results indicate that a total alumina content of approximately 65 per cent. is desirable, such as is obtained in a t.c.p.a. cement/sillimanite mix. On the other hand, a more refractory mix using the fused alumina aggregate is used for the arch

FIG. 16.—*Refractory-concrete lining (t.c.p.a. cement/fused alumina) of a high-frequency induction-furnace used for melting aluminium.*

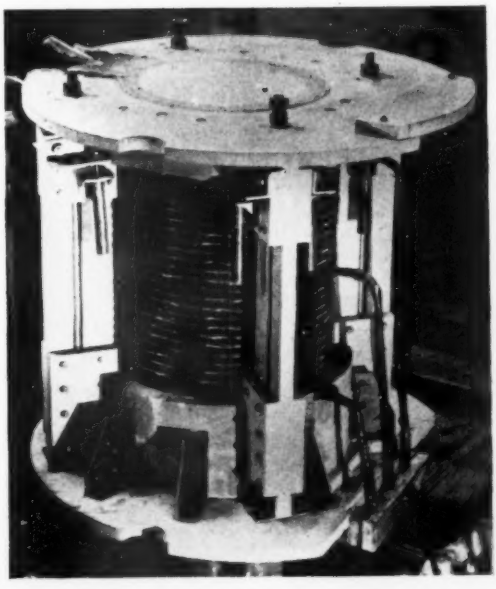


FIG. 17.—*Pre-cast refractory-concrete units for an arc-furnace roof.*

(*Courtesy: Birmingham University.*)

over the slagging hole, which is subjected to extreme temperature and fume, etc., during the oxygen lancing.

As in the Héroult type of arc-furnace, a t.c.p.a. cement/sillimanite mix is also now used for lining the rocking-arc type of furnace melting s.-g. iron or high-temperature non-ferrous alloys. An installation of a lining using a poker vibrator is shown in Fig. 18. After one day of water-curing, the linings are put into a core stove for one or two days, and, before being put into service, are gradually heated by switching the arc on and off until the lining begins to "run" slightly and frit. In both cases (ferrous and non-ferrous melting), the average number of heats obtained from the lining is greater than with the previous rammed lining. For instance, in the case of one furnace melting s.-g. iron the number of heats has been increased by approximately 30 per cent. This extended life could be even further improved but, for considerations of electrical efficiency, the furnace is taken out of commission because re-lining is so relatively simple. The old lining is not removed, and is in sufficiently rough condition after preliminary brushing, etc., to provide a good key for the repair work, which is done in the normal manner using the internal former and poker vibrator.

Resistor-type Furnaces

The maximum operating temperatures of furnaces heated by Nichrome or standard Kanthal resistors is well within the range of h.a. cement refractory mixes, so both refractory and insulating concretes made with this cement have been used for many years for doors, arches, flat roofs, hearths, and complicated special shapes in enamelling and annealing furnaces. The details of the method of construction of a small resistance furnace operating up to 1,250 deg. C. and built completely of castable refractories, have been described.[10] Bogie-type annealing furnaces have been similarly constructed, solely with refractory and insulating concretes. In furnaces of this type, effective insulation and low heat capacity of refractories is obtained by using composite linings of insulating concrete (usually vermiculite or diatomite) faced with a relatively thin layer of refractory concrete, and usually pre-cast units are used. For instance, some pre-cast roof slabs are composite units of 3-in. refractory concrete (crushed firebrick) backed by 10½-in. insulating concrete (vermiculite). The span in these furnaces is usually moderate and reinforcement is, therefore, often unnecessary although mesh reinforcement is sometimes employed. Where strength is of primary importance it is necessary, of course, to use a dense aggregate (*e.g.*, firebrick) and a cement content 50 per cent. greater than in the normal mixes suggested in Table 3. This type of mix was therefore used for bearer skids (6 ft. long by 15 in. wide by 9 in. deep) in a Birlec annealing furnace, and the life of one to three months previously obtained with brickwork was increased to 18 months.

The average iron content of a good quality firebrick is approximately 2 per cent.—this is increased to about 5 per cent. in a h.a. cement/crushed firebrick concrete, and the latter therefore has not been considered particularly suitable for element holders operating at the higher temperatures. However, satisfactory service may be obtained, especially when the units are coated with a proprietary sillimanite-based wash (Pebesil). The position has changed since the introduction of the pure, iron-free t.c.p.a. cement, and the practice of casting lining and element holder as a single unit is growing. This method is adopted using a t.c.p.a. cement/sillimanite concrete backed by a h.a. cement/vermiculite concrete in bale-out furnaces holding aluminium-insulating concrete is also used for lining the lid. In high-temperature furnaces using molybdenum resistors (operating, of necessity, in highly-reducing atmospheres) or platinum wire resistors, the element holders (or the refractory in which the elements are embedded) should be free of silica as well as iron oxides. T.c.p.a. cement/fused alumina mixes are therefore employed. The normal dense aggregate is more often used, but the bubble alumina material is now being increasingly considered, because of its better heat insulation. In one unique application, t.c.p.a. cement/fused alumina mortar was used for a ¾-in. lining of the spherical shell of a small furnace employed for calibrating pyrometers. A ⅛-in. thickness was first applied, then the platinum wire positioned covered with a further ⅜-in. of mortar.

FUEL-FIRED MELTING FURNACES

Crucible Furnaces

Refractory concretes are now used in all types of crucible furnaces for complete linings, top rings, covers, and burner quarls, etc., whilst insulating concretes are becoming increasingly employed for backing purposes. The choice of the most suitable type of mix for a particular furnace is governed by various factors such as the metal temperature, melting rate and type of fuel. In both oil- and gas-fired crucible-furnaces melting aluminium, the lining normally operates at temperatures below approximately 1,300 deg. C. and a h.a. cement/crushed firebrick concrete is therefore satisfactory. In some oil-fired furnaces, however, the lining temperature may exceed 1,300 deg. C. at high melting-rates, and the more-refractory t.c.p.a. cement/crushed firebrick may be necessary. Similarly, with the higher-temperature metals and alloys, t.c.p.a. cement mixes with more-refractory aggregates are usually necessary. For instance, a mix of this cement and sillimanite aggregate is used extremely successfully for lining crucible furnaces melting phosphor bronze—approximately three times the life of the firebrick lining previously used is obtained (see Fig. 19). Occasionally, owing to the use of a heavy-grade oil, mis-alignment of burner, etc., particular parts of the lining are subjected to severe flame-impingement and high local temperatures. In these cases, it is advisable to insert a pre-cast section of a more-refractory mix (*e.g.* t.c.p.a. cement/fused alumina). The latter type of mix is also necessary for the inner lining of furnaces melting steel. In the propane furnace shown in Fig. 20, the steel is raised to a temperature of 1,580 deg. C., and the lining is reported as operating at well over 1,800 deg. C. This furnace is also interesting since it illustrates the use of various types of mixes cast *in situ* as a composite lining. Some of the units shown, such as the extension of the crucible lip, the burner, the combustion chamber, base and crucible support, were pre-cast.

Ordinary refractory concrete (h.a. cement/crushed firebrick) normally gives good service as a lining in natural-draught coke-fired pit-furnaces, but the much more severe conditions obtaining at high melting-rates with forced draught call for a more-refractory type of mix. When attack from the molten clinker of the coke ash and high temperatures are encountered, it is therefore advisable to use a slag-resistant concrete (*e.g.* t.c.p.a. cement/fused alumina). Pre-cast refractory-concrete tops have also been found to give much better service than brickwork in this type of furnace, as they stand up much better to the mechanical abrasion from the coke and pokers when the furnace is being charged.

Reverberatory Furnaces

As in crucible furnaces, the type of refractory concrete employed in reverberatory furnaces naturally varies according to the metal being melted but, in general, h.a. cement/crushed firebrick concrete is suitable for melting- or holding-furnaces handling metals or alloys of low melting-point. For instance, this type of mix is used successfully for arches in zinc-melting furnaces, and for linings in zinc- and lead-holding furnaces

(*Courtesy: S. Russell & Sons, Ltd.*)

FIG. 18.—*Installation of refractory-concret (t.c.p.a. cement/sillimanite) in a rocking-arc furnace, using an immersion vibrator.*

FIG. 19.—*Refractory-concrete (t.c.p.a cement/sillimanite) lid and lining of an oil-fired pit-furnace.* (*Courtesy: Fry's Metal Foundry.*)

Refractory Concrete in Foundries

although, when reducing conditions are present, an iron-free refractory concrete is preferred (*e.g.* t.c.p.a. cement/molochite).

Refractory concrete has been used for many years by the large aluminium producers both in this country and abroad, and tests with various refractories undertaken by one company indicated that refractory concrete was the least contaminated

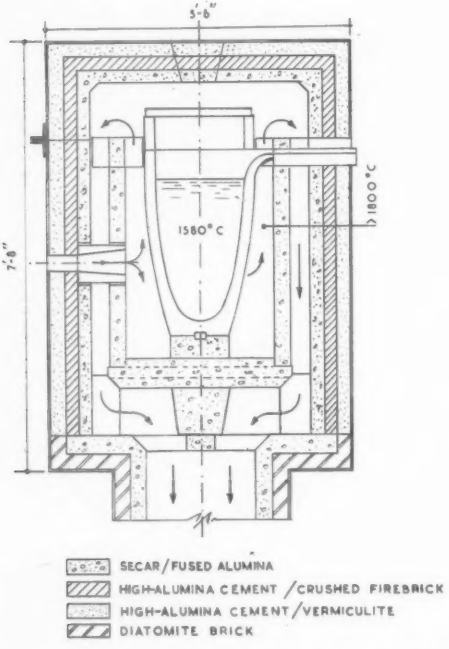


FIG. 20.—*Composite refractory- and insulating-concrete lining of a propane-fired furnace used for the rapid melting of steel.*

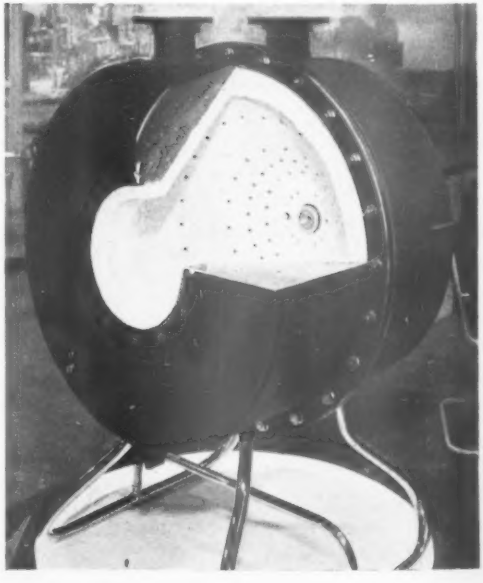
and least wetted by the aluminium. Large furnaces have been completely built of castable refractories, and ordinary refractory concrete (h.a.c./crushed firebrick) is the most widely used. The details of an oil-fired 600-lb. furnace melting aluminium are to be published in the near future and, in this furnace, the refractory-concrete hearth and walls are backed by 3 in. of h.a. cement/diatomite insulating concrete, although some furnaces similarly lined are backed with insulating bricks. In large reverberatory furnaces operating at comparatively high temperatures, a mix incorporating the more-refractory t.c.p.a. cement may be necessary. For instance, in a 5-ton Sklenar furnace used for recovering bronze, a t.c.p.a. cement/calcined low-iron bauxite concrete has improved the life at the "trouble spots" in the furnace many times over. The concrete was used for casting *in situ* three large oil-burner quarls and two sections approximately 3 ft by 3 ft. 9 in. thick on each side of the furnace, one surrounding the charging hole and the other the tapping hole. Good resistance to soda slags has also been obtained with a t.c.p.a. cement/sillimanite lining in de-sulphurizing furnaces holding cast-iron.

Rotary Furnaces

The refractory concretes used so far in rotary furnaces appear to be based only on the h.a. cement. For instance, rotary furnaces melting aluminium use h.a. cement/crushed firebrick refractory concrete for the cone ends and burner quarls incorporated in them. On the other hand, proprietary premixes consisting essentially of this type of cement and basic aggregates are preferred where conditions of high temperature and/or slag resistance obtain. For instance, a magnesite-chrome-based castable refractory may be used for rotary furnaces melting copper, etc., whilst a mix employing a magnesite aggregate is recommended for lining rotary and semi-rotary furnaces melting lead. The lining of a rotary furnace or kiln is usually cast in sections approximately a quarter of the circumference wide by 5 ft. to 6 ft. long in chequer-board fashion, so that butt-joints between sections are obtained. It is interesting to note also that composite linings of refractory and insulating concretes may be cast successfully in this type of unit.

FIG. 21.—*Refractory-concrete (t.c.p.a. cement/fused alumina) lining of high-duty oil-fired combustion-chamber.*

(Courtesy: Urquhart's (1926), Ltd.)



Cupolas

The conditions in the melting zones of cupolas are, of course, too severe for refractory concrete made with the ordinary grey h.a. cement and crushed firebrick aggregate, but this type of mix has been found to give extremely good service as a lining for the cooler zones (approximately the upper two-thirds). Since abrasion resistance is of prime importance, the lining should be cast between the cupola shell and internal shuttering, and not simply plastered on. Pre-cast units have also been employed. Similarly, in the melting zone, trials with pre-cast units of t.c.p.a. cement/fused alumina concrete have given extremely good results. It is possible that a calcined magnesite aggregate could also be used with this cement satisfactorily in this zone. A cupola may be considered as approximating to a small blast furnace, and it is not surprising, therefore, that the applications of refractory concrete in the two units are also similar. For instance, refractory concrete is used extensively at the top of the blast furnace for bedding and backing wearer plates, and a recent patent[11] describes a similar method (whereby the top part of the cupola is protected from mechanical damage during charging by vertical lengths of railway lines positioned at 8-in. centres and flush with the surface—refractory concrete is cast between and behind them). A further analogy is in the use, in both cases, of refractory concrete for iron and slag runners. It is normal practice to give these runners a coating of fireclay or blacking. Similarly, just as castable refractories are employed for lining the bustle pipes, hot gas mains, etc., in blast-furnace plants, they are also used for lining the flues, etc., of hot-blast cupolas, and the combustion chamber of the oil-fired units supplying the hot blast in non-recuperative systems. A t.c.p.a. cement/fused alumina concrete is used for lining the combustion chamber (shown in section in Fig. 21) of an oil-fired direct air heater. The lining operates at approximately 1,800 deg. C., the heat release obtained being 4,500,000 B.t.u. per hr.

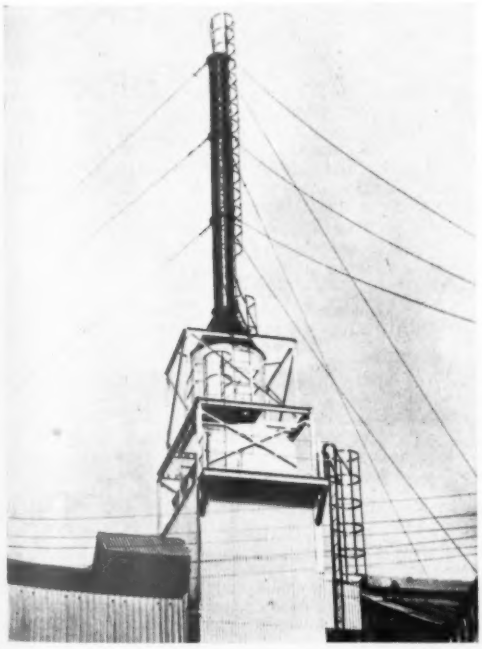
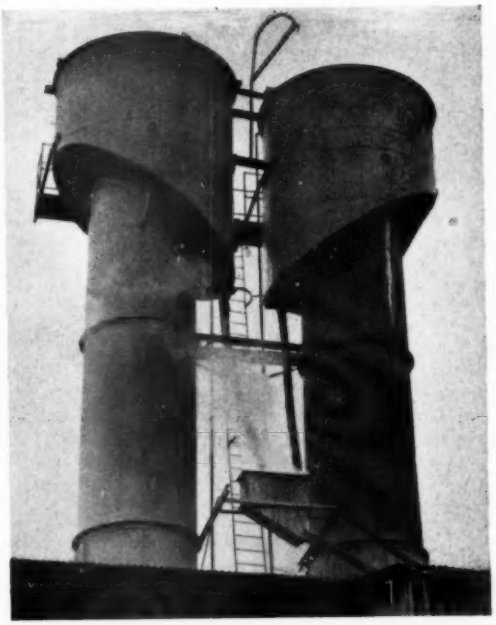


FIG. 22.—*Refractory-concrete-lined spark-arrestor.* (*Courtesy: James Hodgkinson, Salford, Ltd.*)



(*Courtesy Saunders & Connor, Federated Foundries Group*)

FIG. 23.—*"Water spray" spark-arrestor lined with h.a. cement/whinstone mortar.*

Refractory or heat-resistant concretes are also used for lining various types of spark arrestors. For instance, one installation consists essentially of an upturned rectangular box from the roof of which is suspended a boiler end over the top of the cupola, both the boiler-end and the box being lined with refractory concrete. Other types of installation are shown in Figs. 22 and 23. The cone at the top of the unit shown in Fig. 22 is lined with refractory concrete and the spark arrestor is cast *in situ*, using a similar mix on arched steel shuttering across the chamber. The steel shuttering is left in place and eventually burns away. The lining of the top cylindrical section of the installation shown in Fig. 23 was applied by the gunning technique. Spark emission is prevented by a water spray played on to a cone so that a curtain of water is formed between

the lined shell and the cone, *i.e.* across the gap through which the sparks must pass.

Floors and Foundations

Increasing use is now being made of h.a. cement concretes, employing suitable refractory aggregates, for foundations and base slabs of all types of furnaces, cupolas, etc. By this means a flat foundation is obtained which also has a higher heat-insulating value than the same thickness of firebrick.

CONCLUSION

Like heavy industry in general, foundries have been making increased use for many years of refractory and insulating concretes in the construction of furnaces, floors, flues, etc. The availability in recent years of the super-duty castable refractories based on the pure white t.c.p.a. cement has stimulated this increase by extending their potential use to practically all refractory applications. For instance, in melting furnaces where high refractoriness, slag resistance or purity is a prerequisite of the refractory employed, the super-duty refractory concretes are tending in some instances to replace ramming mixes since, unlike the later, they are not so susceptible to installation techniques and may be put into service in a comparatively short time. Nevertheless, the greater proportion of refractory concretes employed in foundries are based on the well-known grey high-alumina cement, since most of the large refractory installations (*e.g.* annealing furnaces, foundations, flues, etc.) do not demand high-duty refractories.

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Engineering Output rising

Production in the engineering and electrical goods industries in June is estimated by the Board of Trade to have been 2 per cent. more than in June, 1958. The increase was smaller than in May, but it brought the volume of production in the second quarter to 6 per cent. more than in the corresponding period of last year.

Orders on hand in the industries concerned at the end of June were maintained for the fourth month in succession, thus indicating that the long period of contraction in the industries' order-books has ended. The index for orders on hand at end-June for exports was 82 (1958 = 100), compared with 93 a year ago and 104 at the beginning of 1957. For the home market the index was 87, compared with 96 and 106.

Details of foreign trade in electrical and non-electrical machinery of all kinds, issued by the British Engineers' Association shows that UK exports to the Outer Seven countries has been rising. In 1957 they were worth £62,400,000 last year £66,900,000.

Heat-resisting Chromium Cast Irons

Bradley Magazine, No. 77, issued by Bradley & Foster, Limited, Darlaston, Staffs, carries a very interesting article on the subject of "Heat-resisting Chromium Cast Irons." It opens with a review of earlier work by Burgess and Hallett, but one phase of the growth phenomenon of cast-iron under repeated heatings is not touched upon. That is, the mechanical aspect which postulates that in a brittle material, the differential expansion of the inside of a thickish section and the external layer induces surface cracking. This thought was expressed to the reviewer by the late Dr. Hurst.

What follows is culled from the original article:

Extensive experiments have been carried out in the Bradley laboratories and heat-treatment departments to determine the best material for use in heat-treatment pans for temperatures up to 1,000 deg C. Amongst a variety of operations, the most arduous is where the items being treated are carried on pans through a range of temperatures during a period of seven hours, consisting of 2½ hours at 950 deg. C., cooling down to 800 deg. C. in the next 2 hours and and then to 600 deg. C. in the remaining time, when the components were withdrawn from the furnace to air cool. Pans made from ¼-in. mild-steel plate had been used, and whilst they were reasonably satisfactory, their life was comparatively short, whilst the scale which fell from them, steadily built up on the furnace floor, necessitating frequent stoppages for its removal. Heat-resisting steels of the austenitic stainless type were tried, but whilst being satisfactory from the heat-resisting point of view they were unsuitable owing to severe warping. Experiments were then carried out with high-chromium cast-iron pans. The first tried were made from 28 per cent. Cr. 2.8 per cent. carbon iron but these failed due to cracking, the material having very little resistance to thermal shock. The low-carbon alloys, 26 per cent. Cr., 2 per cent. carbon and 20 per cent. Cr., 1 per cent. carbon were then tried and both of these have proved satisfactory, having a good resistance to thermal shock. They have an almost indefinite life, failing not from oxidation, but due to warping and cracking as a result of physical deterioration, which takes place after long periods of use. Their life is many times that of mild-steel pans and there is no trouble due to the build-up of scale in the furnace.

ECSC Steel Output

The lead over last year's steel output in the European Coal and Steel Community was maintained in August. Although, owing to holidays, there was a comparatively small drop in output compared with July, the August figure of 5,068,000 tons was nearly 700,000 tons better than a year previous (4,376,000 tons). The trend was reflected by all six Community countries.

For the first eight months of 1959 total output of 40,282,000 tons is 3.3 per cent. greater than the 38,985,000 tons of the corresponding period last year. For the first time this year output in all the ECSC countries without exception is now running ahead of 1958 and there is every sign that a record production of between 61,000,000 and 62,000,000 tons will be achieved.

Output of pig-iron and ferro-alloys in August also continued at a high level, reaching 3,862,000 tons, compared with 3,937,000 tons in July and 3,470,000 tons a year ago.

Desirable Properties of Cupola Coke

Extracts from an IBF Technical Sub-committee Report

In presenting the report on the desirable properties of cupola coke submitted by sub-committee T.S.47 of the IBF Technical Council at the conference in Scarborough, the chairman of the sub-committee, Mr. L. W. Bolton, made the following remarks:—

Sub-committee T.S.47 of the Technical Council was appointed in February, 1954; it had during its life 19 members including experienced ironfounders and representatives of the research associations (the British Cast Iron Research Association and the British Coke Research Association, the Fuel Research Station), the Coal Board and the University of Sheffield. The decision to appoint a sub-committee arose from complaints with regard to the quality of foundry coke which were brought to the attention of the Institute's Technical Council. It will be remembered that at that time production in the ironfounding industry was running at a very high level and foundry coke was in short supply. The industry was still very conscious that the manufacture of coke had been largely taken from the hands of private enterprise and had become a virtual monopoly.

Most foundrymen were agreed that coke "wasn't what it was" but few were prepared to commit themselves regarding the way in which it had deteriorated. Still fewer were able to suggest the properties an ideal coke should possess. The sub-committee was, therefore, appointed and instructed to review the present position of foundry melting coke and to prepare recommendations regarding coke specification and practical tests to evaluate coke quality.

Virtue of Consistency

When the sub-committee had met and given consideration to the position as it then was, it was agreed that the most important property or quality that a melting coke could possess was consistency from consignment to consignment. In other words, the capacity of a coke to give reproducibility of metal composition and temperature from day to day. It was made clear from experience of user members that a consignment of coke of rather better quality than that normally supplied could cause just as much trouble in some foundries as a consignment which was below standard.

The next stage of the work consisted of a survey of the literature in an endeavour to ascertain the properties of a coke which had the most important influence on the results it would give when used in the cupola and the tests available to evaluate these properties. Knowledge was also sought whether laboratory tests could be of use in indicating the value of a coke under production conditions in the foundry.

All the important papers referring to foundry coke and published between 1920 and 1957 were carefully examined and abstracted, and tribute must be paid to those members of the sub-committee who undertook the very considerable task of preparing these abstracts.

The first fact emerging from this review of the literature was that coke size is a dominant factor influencing combustion reactions in the cupola and that size can influence temperature, rate of melting, and combustion conditions to a very marked degree. It was also generally agreed that the efficient operation of a cupola requires coke within certain size limits and that within these limits uniformity of size has an important bearing on operational results.

Coke Size and Strength

A first requirement of a coke of consistent quality, therefore, is that coke size should be consistent from consignment to consignment and that the size of the individual pieces should be uniform. Bound up with this question of size is the strength of the coke. Strength is needed to minimize size degradation on handling and also during cupola charging and operation. It should be mentioned here that both size and strength are influenced by the amount of fissuring in a coke. (The sub-committee was well aware that by the nature of the process used in producing coke, fissures must be present.) Because of its influence on the two most important properties of a coke—size and strength—it is vital that, in a consistent coke, fissuring shall be consistent.

Ash Content

The next most important factor was seen to be ash content. Obviously the higher the carbon content of a coke, the greater would be the amount of heat it possessed. The detrimental effect of ash is, however, greater than would be expected solely from its influence on the carbon content of the coke. A high ash means more slag must be produced and heated and thus less heat is available for superheating the metal.

Cupola practice can be adapted to suit cokes of differing ash contents, but such modifications to practice cannot be made from day to day. Where a practice has been established to secure a certain temperature or pick-up of carbon using coke of a certain ash-content, heavy losses from defective castings can arise if coke of higher or lower ash-content is inadvertently delivered. Close control of ash-content is therefore very necessary.

The three factors, strength, size and ash content appear from the literature to be the main considerations, and there is no indication that other properties are of similar importance. With regard to reactivity for example, opinions in the literature with regard to the advantages and disadvantages of high- or low-reactivity seem to suggest that this is

relatively unimportant so far as the cokes available in the United Kingdom are concerned.

Testing

Consideration was then given to the various means available for testing the strength of coke and these were fully described in the Sub-Committee's report. The opinion of the Sub-committee is that at the present time the shatter test is probably the most generally used and satisfactory method. It was suggested that some form of simple compression-test might be developed as an alternative. Methods available for estimating the average size of a coke were considered; the estimation of ash content presented no difficulties, it was stated.

When considering whether laboratory tests could give any indication as to the suitability of a coke in the cupola it was agreed that no case had ever been reported of a coke with a high shatter-index and a low ash-content giving unsatisfactory results in the cupola.

The Sub-committee had then turned its attention to the possibility of carrying out experimental work in the foundries of members to confirm the findings from the survey of the literature. It was found that there were considerable difficulties in carrying out controlled experimental melts under production conditions.

Liaison Work

The Sub-committee had been fortunate during the whole of its life to be kept in close touch with the experimental work on coke size carried out by the British Coke Research Association. This work (see Appendix I) is the most comprehensive ever undertaken on cupola coke, and the Institute and indeed the whole foundry industry owes gratitude to the Coke Research Association for undertaking very large-scale practical trials. The conclusions drawn from this work, which were made public for the first time in the report, gave definite confirmation of the importance of coke size. They showed that, under the conditions of these tests, coke in certain sizes gives hotter metal and faster melting than the same coke in a smaller size.

The report concluded by putting forward the Sub-committee's suggested desirable requirements for coke delivered to the foundry (Appendix II). Some members may believe that these do not go far enough; some producers may consider that they go too far. The Sub-committee suggested that they should represent at least a basis for discussion and it was hoped, a basis for agreement.

APPENDIX I

Work carried out by the British Coke Research Association

In this investigation the primary aim was to define the effect of coke size on cupola performance. Three size ranges of a good-quality Welsh foundry coke were tested on a continuously-tapped cold-blast cupola of 46-in. i.d. operating with a metal : fixed-carbon ratio of 14 : 1 (metal : coke ratio, 12.5:1)—mean air rate 3,300 cub. ft. per min. The coke was sized 1-3 in. (mean size 2.4 in. as charged), 3-5 in. (mean size 3.7 in. as charged) and +5 in. (mean size 5.0 in. as charged). Ungraded coke as normally charged was also tested for comparison.

The coke as delivered was graded in a plant adjacent to the furnaces by vibrating double-deck screens. Samples for size analysis were taken after screening and immediately before charging the cupola, so that size degradation due to handling could also be determined.

The criteria used to assess the cupola performance using different coke sizes were as follow: (i) Molten-metal temperature; (ii) melting rate and metal : air ratio (the weight of metal melted by a standard volume of air, lb. per 1,000 cub. ft.); (iii) combustion ratio of the waste gases* and fixed-carbon : air ratio; (iv) heat efficiency and heat distribution within the cupola; (v) metal quality, and (vi) general cupola operation.

To obtain the data required for an assessment of the cupola performance it was necessary to devise an adequate system of instrumentation and sampling procedure, which allowed for the determination of the weights and composition of the materials charged and the resultant products.

A continuous record of the molten-metal temperature and an assessment of the properties of the metal, coke, limestone, slag, and waste gases was obtained, together with a determination of the volume, temperature, pressure, and humidity of the air supplied.

Conclusions

The results of the tests carried out under these conditions indicated the following conclusions:

(1) Coke size caused changes in cupola performance between means sizes of 2.4 in. and 3.7 in., but had no significant effect between 3.7 in. and 5.0.

(2) The temperature of the molten metal increased from 1,379 deg. C. with the 1-3-in. coke, to 1,425 deg. C. with the 3-5-in. and +5-in. grades.

(3) Temperature recovery of the molten metal after off-blast periods greatly deteriorated with the 1-3-in. coke as compared with the other grades tested, but a satisfactory cupola performance was possible.

(4) The combustion ratio increased from 0.55 with the 1-3-in. coke, to 0.64 with the 3-5-in. and +5-in. coke grades.

(5) The fixed-carbon : air ratio decreased from 9.1 lb. per 1,000 cub ft. with the 1-3-in. coke to 8.6 lb. per 1,000 cub. ft. with the 3-5-in. and +5-in. coke grades.

(6) The metal : air ratio decreased from 128 lb. per 1,000 cub. ft. with the 1-3-in. coke to 120 lb. per 1,000 cub. ft. with the 3-5-in. and +5-in. coke grades. It should be noted that, although more metal was melted per 1,000 cub. ft. of air with the 1-3-in. coke than with the other two grades, in practice an actual decrease in the melting rate may

* The combustion ratio is (CO_2 per cent.): (CO_2 per cent. + CO per cent.) on a volume basis.

occur as the extra pressure required to maintain the air rate with the 1-3-in. coke may not be available and the decrease in air volume may not be sufficiently compensated for by the increase in the metal : air ratio.

(7) There was no significant change in the heat efficiency of cupola melting with change in coke size.

(8) The main effect of coke size on heat-distribution within the cupola was shown in the potential heat of the stack gas: this decreased from 32 per cent. with the 1-3-in. coke to 26 per cent. with the 3-5-in. and +5-in. grades.

(9) Chemical analysis of the molten metal gave no indication of any significant change in metal quality with change in coke size. It should be noted, however, that the metal melted in these tests was not of a composition with which carbon pick-up would normally be expected.

APPENDIX II

Specification for Cupola Coke

The Sub-committee considered various suggested specifications for cupola coke, particularly in the light of the experience of user members. It is stressed that the first consideration is regularity of quality but the following figures for coke delivered to the foundry are considered to represent desirable requirements of the industry:

		Per Cent.	
Moisture		2.0	max.
Volatile matter		1.5	max.
Ash		8.0	max.
Sulphur		0.7	max.
Fixed carbon		90.0	min.
Shatter index*	2 in.	90	min.
	1½ in.	95	min.
Size†		90	between 4- and 7-in.
		Not more than 5	below 2-in.

* Not all foundries require shatter indices as high as the above and some are able to achieve satisfactory results with 85-92 per cent.

† Many foundries require this range but those operating small cupolas are able to use coke as small as 2-4 in. Coke in the sizes quoted is understood to mean coke with pieces which are generally between these sizes in one direction.

Conclusions

The Sub-committee drew the following conclusions:

(1) The ideal coke for use in cupola melting is one which, with a standard practice, will give consistent and satisfactory results with regard to metal temperature, metal composition, and rate of melting. Consistency in all coke properties from consignment to consignment is, therefore, most desirable.

(2) The two properties having the greatest influence on consistency are size and ash-content. Uniformity of size and regularity of ash-content are essential conditions for uniform cupola operation.

(3) The size of coke as used in the cupola is shown to be dependent on its strength and on the extent of fissures which may be present.

(4) It appears that a coke with a minimum of fissuring, with a shatter index high enough to withstand the normal handling which a cupola coke receives, and containing 90-92 per cent fixed carbon, would overcome most of the present difficulties arising with cupola coke.

(5) To cater for cupolas of various sizes, it is desirable that the coke should be made available in two sizes, say, 3-in. average size for small, and 5-in. average size for larger cupolas.

(6) It is, however, believed that a supply of 4-in. average size closely-graded coke, meeting the above conditions, would be of immediate benefit to a large section of the ironfounding industry.

Cast-iron Bells

By C. J. Robb

People are inclined to take it for granted that, in the past, bells were always made of bronze or bell metal, but in fact this is not so. Ireland was the home of early campanology, bell-making being a fine art in the days of St. Patrick. Iron plates were used in this early tintinnabula, the bells being wedge-shaped with the plates riveted together (see Fig. 1). It is recounted that in the Near East, in the days of remote antiquity, bells were made from iron known as *bad en pe* ("heavenly metal"), which was claimed to be "meteoric" metal fallen from the skies. This made the bells sacred, and may be the origin of the early ecclesiastical associations.

Some of the old iron bells were covered with thin plates of bronze to protect them from corrosion, and ornate shrines were built for the same purpose in the original sense. Bells made of cast-iron were known to the Anglo-Normans in Ireland in the thirteenth century, but the castings were rather crude. It was not until the sixteenth century that cast-iron bells were made by actual ironfounders. Cast-iron bells have a good sharp tone, but the risk of cracking is great. However, some early American bells of cast-iron have remained sound since the eighteenth century. It was in the United States that the first cast-steel bell* was made—bells of this metal are as good as those in bell metal, and have high musical note in most cases.

* Germany is usually credited with the first cast-steel bell. Jakob Meyer exhibited a number of them at Düsseldorf in 1851.—*Editor.*

Equipment & Supplies

Cupola Gas-collector

Gas emission from cupola stacks varies very widely with operating practice, gases ranging in percentage composition from CO 10 to 15; CO_2 5 to 20; O_2 5 to 25; N_2 and some SO_2 at temperatures of 500 deg. to 2,000 deg. F. (260 to 1,100 deg. C). Entrained in these gases are varying amounts of iron oxides, silicates, carbonates and other metallic compounds, ranging in size from large particles several millimeters in diameter to those in the sub-micron range. The solids in the stack gases which are discharged to atmosphere amount to as much as 10 lb./min. in large installations, emissions which infringe the requirements of the Clean Air Act. The Holmes Schneible cupola collector (Fig. 1), made by W. C. Holmes & Company, Limited, Turnbridge, Huddersfield, consists of an outer shell and collection trough supported on an angle ring welded to the cupola stack. A deflector cone is supported from the collector shell in such a way that the cupola gases are confined to the annular passage between the edge of the cone and the collector shell.

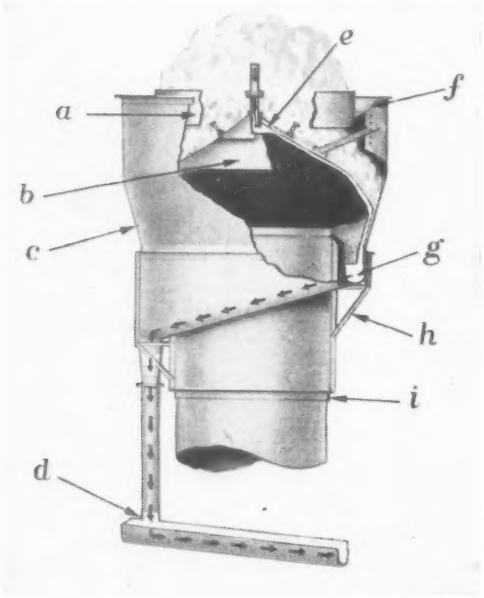

FIG. 1.—*Cupola gas-collector manufactured by W. C. Holmes & Company, Limited, of Huddersfield.*

a—Adjustable spring eliminator; *b*—Adjustable deflector cone (water cooled); *c*—Extra heavy steel shell (water cooled); *d*—Drain water to settling a re-circulating system; *e*—Non-clogging Finley adjustable water distribution head; *f*—Deflector ring; *g*—Collector trough; *h*—Supporting brackets; *i*—Support flange.

Non-clogging Distribution Head

A non-clogging distribution head distributes the water over the surface of the cone without the use of sprays. The water leaves the circumference of the cone and forms a heavy water curtain through which the gases have to pass, causing the ash and cupola grits to be retained. The water and collected solids impinge upon and run down the inside of the collector casing into a collection trough, which is self draining and is provided with an outlet from which the water and solids discharge to a recirculating tank.

Improved Loader

E. Boydell & Company, Limited, Elsinore Road, Old Trafford, Manchester, 16, the makers of the Muir-Hill range of loaders, have recently introduced another version of their 2-WL model, specially modified to meet the requirements of foundries, gas works and similar industries in handling and loading coke and small coal. This model is fitted with a Fordson Power Major engine, and a 2-cub. yd. capacity bucket. The main lifting beam has been increased in length by 15 in., and a 40 deg. roll back is provided in the bucket action. In addition, the reset rams have been increased to 4 in. dia. Substantially higher loading rates are claimed for this machine, together with the ability to stock-pile small coal up to a height of 12 ft. It is further claimed that a lorry with 9-ft. 10 in. sides may be loaded with 14 tons 6 cwt.of 1-in. coal in 5 min. 57 sec. (13 buckets), and that comparable rates of loading are possible even when the coal lies with little or no piling.

Modified Spray Gun

When air compressed to a pressure of 60 to 80 lb. per sq. in. travels through the torjuous paths formed in the body of a spray gun, there is inevitably a pressure drop caused by friction. The Bullows-Binks spray gun (Model 19), manufactured by Alfred Bullows & Sons, Limited, Long Street, Walsall, Staffs, has been the subject of considerable development work on this problem. By making minute drillings in all parts of the air passages, it has been possible to study the behaviour of the airstream within the gun body in terms of velocity, direction and pressure. The lessons learned have been applied to all guns now being produced, and modifications to the air passages are claimed to have produced a substantial improvement in performance of this gun. These modifications can be made to existing gun bodies at the makers works at a very moderate cost, and may be worth while for all users interested in high speeds.

Isotope Branding: Sandviken Jernverks AB are using an isotope to identify casts of steel in their production of tubes for two heat-exchangers for Sweden's first commercial atomic reactor (which is to be erected at Farsta, south of Stockholm). With each 4½-ton melt of steel, about 5 gm. or a radioactive Tantalum isotope is put into the ladle during casting, by means of 3-ft. tongs. Radiation from the ingots is of sufficient strength to permit identification of the tubes after nine months. However, the intensity of radiation from the ingots is so low that no special precautions have to be observed in the handling of the material.

Automation for the Small Firm : Gresham Developments, Limited, Thirlestane House, Uxbridge Road, Hampton Hill, Middlesex, have developed a unit sequencing system which enables any manufacturing process to be sequentially controlled, automatically, from a central position. It is actuated by means of electrical signals received on completion of each stage of a production process. This may be a pre-determined time, temperature, pressure, weight, number of revolutions, power, density, rate of flow, etc. Operations that may be controlled include mixing, heating, cooling, pumping, conveying and, in fact, practically any operation which can be controlled or carried out electrically.

Australian Symposium on Foundry Coke

A two-day symposium on "Production, Properties and Utilization of Foundry Coke" was held during the spring of this year in Sydney, N.S.W. It was staged by the Coal Research Section of the Commonwealth Scientific and Industrial Organization, some 60 representatives of industry being present. Two of the papers were of particular interest to foundrymen, and are summarized in the following article.

The first paper presented at a recent symposium, in Australia, on foundry coke dealt with the effect of prolonged storage on the carbonizing properties of high-volatile coals—a subject which is rather remote from foundry interests. The second, presumably of Russian origin, "Thermo-mechanical Properties of Metallurgical Coke" by Mr. P. A. Scukin, was presented by Dr. K. F. Baker. The main conclusion arrived at was that the higher the strength of a coke at room temperature, the higher will be its strength at the temperature of the blast furnace. However, Dr. Baker pointed out that recent work in the USA had led to the opposite conclusion, namely, that it was impossible to predict the behaviour of coke at elevated temperatures from measurements of its mechanical strength at room temperature. The third paper was of considerable interest to founders, and is abstracted below.

High-carbon Coke

By A. Dahlmann

(Paper presented by H. R. Brown.)

A patented substitute for foundry coke prepared from a mixture of anthracite, coking coals, and a liquid by-product of petroleum refining, which was developed a few years ago in the USA under the name "Densite," has given good results for cupola use in Germany and more recently in Australia. It is of lower ash-content, lower porosity, higher true and apparent density, and greater average cell-wall thickness than conventional foundry coke. Tests show that, using Densite coke graded 60 to 80 mm., the same melting result is obtained with about 30 per cent. less carbon than with ordinary foundry coke. However, Densite offers no substantial advantages where foundry coke of high quality is available and the cupola can be operated under optimum conditions, *i.e.*, producing maximum iron temperature for a given coke charge.

Densite gives higher carbon pickup, and a reduction in refractory burnout and wear of the cupola lining, as compared with ordinary foundry coke. The greater the distance of the foundry from the coke-making plant the more attractive is the use of Densite, because, as transportation costs increase, the financial advantage of being able to produce the same amount of cast-iron with a smaller quantity of coke increases. Circumstances where it would be economically advantageous to change over to Densite include: (*a*) where time is limited and high melting rates are, therefore, essential (*b*), where there is little storage space for coke, and (*c*) where supplies of ordinary foundry coke are subject to wide variations in quality.

The results of full-scale tests of Densite at a large Australian foundry have shown that it has the following advantages (in addition to those already mentioned) over ordinary foundry coke: higher melting rates; a reduction in the limestone charge, due to the lower ash content of Densite, and longer periods of continuous operation.

DISCUSSION

MR. GREENBANK (Malco Industries) opened the discussion with some comments on the size of cupolas in relation to their performance. He mentioned a foundry, engaged in the manufacture of malleable-iron castings, where the cupolas operated at a temperature of 770 deg. C. just below the charging door, this door being about 12 to 15 ft. above the tuyeres. The corresponding figures for overseas practice were 315 to 480 deg. C. and 20 to 30 ft. What was the reason for the higher cupola stacks used overseas, and what was the optimum height?

Replying, MR. BROWN said that for maximum thermal efficiency it was essential to use as much of the heat as possible, and that meant a high stack.

MR. SHIRES added that ultimately the question was one of economics—balancing the expense involved in providing and operating larger blowers against the value of the extra heat recovered.

MR. GILES (Meehanite Industries) said that the 30-ft. high cupolas used in the USA were mechanically charged; consequently harder cokes were needed than those employed in Australia. It was not known whether in US practice the degree of breakage was greater. The cokes were more carefully graded than in Australia—4-in. and 5-in. sizes were common, and the usual stack height was 15 ft. If a better system of coke sizing was practised in Australia it would be advantageous to use higher stacks and mechanical charging with home-produced cokes, provided optimum conditions were maintained in the cupola.

MR. ANDREWS (General Motors-Holden) said that his company had purchased a trial shipment of 500 tons of Densite coke from Germany, and had found that the claims made for it were justified. With a cupola of 51-in. internal dia., Densite coke (9 per cent. of the charge) gave a temperature

(metal) of 1,550 deg. C. and a melting rate of 10 tons per hr., compared with 1,460 deg. C. and 6 tons per hr. for ordinary foundry coke (14 per cent. of charge). Also, being lower in ash and giving a more basic type of slag, Densite enabled a considerable reduction to be made in the limestone charge. In the last two months his company had changed over to hot-blast cupolas, to avoid the necessity for importing special coke, and had found that heat losses could be reduced by giving a downward inclination of 7 deg. to the tuyeres, and by using an air velocity of 100 ft./sec. through them. Offtake temperatures were thereby considerably diminished. With hot blast, coke ratios were improved and there was no fall in metal temperatures—the optimum period of continuous operation was 16 to 30 hr.

Effect of Aerodynamic Factors on Cupola Operation

By G. L. Shires

This paper gave an account of a series of experiments, with a cold model, to determine what aerodynamic factors are important in the operation of cupolas. A two-dimensional Perspex-sided model was used, simulating a section through a 1-ft. dia. cupola; a section 4 in. in thickness was chosen, in order to cover at least three particle diameters for the largest of the test cokes (1 to 1½ in.) The aim of the first part of the investigation was to measure the effects of blast rate, coke size, and bed height on tuyere pressure. High-temperature coke, crushed and sieved by hand to the three size ranges, namely ¼ to ½ in., ½ to 1 in., and 1 to 1½ in. was used as a charge, the mean sizes representing ratios to maximum cupola width of 1/32, 1/16, and 1/9.6. Static pressures were measured by tappings arranged in a grid of 2-in. squares over the back Perspex plate, and connected to a bank of water manometers containing both vertical and inclined tubes (for high and low pressures respectively).

A factor which proved to be of particular interest was the bed height. When this exceeded a critical value, corresponding to a level of a few inches above the tuyeres, the pressure drop was proportional to the bed height. At lower bed heights the relationship was non-linear, owing to the influence of the tuyeres. For a particular configuration and various coke sizes the critical bed height was found to be roughly proportional to the square root of the tuyere pressure.

Blotting-paper Test

The pattern of flow within the bed was studied first by measurements of static pressure, and observations of the traces left on the coke after the injection of some fine aluminium-oxide powder—later by a method of flow visualization in which a piece of blotting paper, impregnated with cobalt-chloride solution and dried, was attached to the inside of the front Perspex plate in contact with the coke. When dry, the sheet was pale in colour, but the introduction of steam into the air stream immediately produced a pink stain, indicating the main path of the air stream. The zone in the centre of the cupola between the two stains showed no sign of condensation, and it was evidently one through which insufficient air passed to cause reaction with the cobalt chloride. A comparison of traces so obtained with the patterns given by aluminium-oxide powder showed good agreement.

A difference in the degree of penetration was observed when using different coke sizes, and a reduction in the extent of the centre "dead zone" when the coke size was increased. However, with horizontal tuyeres, complete penetration by the main air-jet to the centre of the 12-in. wide cupola was not obtained, even with the largest coke (representing a ratio of coke size to cupola width of approximately 1/10). For the larger sizes of coke there was a marked increase in penetration when the tuyeres were inclined downwards at an angle of 12.5 deg., and maximum penetration was attained with a lower tuyere velocity than with the horizontal tuyeres.

Comparison of the results given by the model with full-scale results reported in the literature, led to the following conclusions:

(1) The higher metal temperature, and the improvement in cupola performance with increase in coke size, are due largely to the greater penetration of the air from the tuyeres into the coke bed; (2) with cold-air blast, there is a partially-cooled zone near to the mouth of the tuyeres which increases in extent with coke size, so that best penetration is obtained with coke sizes in the range one-twelfth to one-eighth of cupola width; (3) the increase in metal temperature with increase in tuyere velocity (for the same blast rate) is relatively small; but with a cold-blast refractory-lined cupola the accepted values of between one-quarter and one-sixth for tuyere ratio may be too large; (4) downward inclination of the tuyeres gives a small increase in metal temperature associated with a downward movement of the zone of maximum temperature, and (5) in the zone near the cupola walls, where the coke is less closely packed than in the centre, a large proportion of the air can escape, thus reducing the intensity of combustion in the centre of the cupola and adversely affecting the metal temperature.

DISCUSSION

The discussion was opened by MR. GILES, who inquired the cause of the pressure variations in a cupola during the first 30 min. after lighting-up.

The explanation suggested by MR. SHIRES was that once the coke at the bottom of the cupola was burning steadily the whole bed eased itself and there was a change in the voidage, which affected the pressure drop through the bed. The pressure drop would probably differ according to whether the cupola was loaded with the blast on or off.

Other speakers mentioned that the pressure would increase owing to the expansion of the air passing through the tuyeres, as the temperature of the cupola increased; and that the pressure

would be affected by the differences in the structure of the bed produced by different methods of charging.

MR. ANDREWS had noticed that, with Densite, the tuyeres were just as red-hot after 16 hours' operation as at the beginning of a run; whereas with Australian cokes the high cooling effect predicted in Mr. Shires's paper caused a region of "black" coke extending 12 in. from the tuyeres. He had tried to combat this by increasing the air velocity through the tuyeres, but gas-analysis measurements on the waste gases had shown that there was a limit to the improvement which could be secured in this way.

A speaker representing the coke makers said that they would welcome a lead from the foundrymen on what demand exists for plus-6-in. cokes, and for minus-4-in. plus-2-in. cokes. At present, coke was being supplied in Australia in those two sizes and also minus-6-in. plus-4-in., the minus-2-in. fraction being screened out. Many foundrymen preferred to buy minus-6-in. plus-4-in. coke and break it down to the particular size they needed.

MR. BROWN said that by so doing they avoided taking delivery of a lot of weak coke ("black ends") in the minus-4-in. plus-2-in. size range.

MR. GILES considered that there would be little demand for plus-6-in. coke, as it would be suitable only for cupolas of a greater diameter than 50 in. For the majority of cupolas (32 to 48 in. dia.) minus-6-in. plus-4-in. would be the most suitable size.

MR. ANDREWS said that, for the two 72-in. cupolas which his firm had installed at their works in Melbourne, they had tried a range of coke sizes from 4 to 8 in., but 50 per cent. of the coke normally used was plus-2-in. The most desirable size appeared to be minus-6-in. plus-4-in., or minus-7-in. plus-5-in. as loaded at Sydney. The size grading of the coke they bought from overseas was 80 per cent. plus-4-in., 15 per cent. minus-4-in. plus-2-in., and 5 per cent. minus-2-in. The coke was purchased as nominally minus-8-in., plus 5-in., and was supplied in bags.

MR. CALLCOTT, MR. ESCHER, and MR. ANDREWS favoured the use of hot-blast to compensate for the inherent disadvantages (such as high ash content) of Australian cokes. It was said that hot-blast gave a saving of 25 per cent. in coke consumption, and lower silicon and manganese losses.

MR. LEEDER said that, since Australian consumption of foundry coke was so low (150,000 tons per annum), it was impracticable to produce it in a wide range of sizes. He suggested that a questionnaire be circulated to the foundries operating in Australia, to find out what sizes were most generally in demand.

MR. BROWN, however, thought that the coke manufacturers should take the matter into their own hands and offer to the consumer a consistent product of graded size suited to his requirements. He added that the Coal Research Section was prepared to make available a review of coke sizes in use in Australia and overseas.

THE CORFO, Chile, is to establish—in conjunction with the Asociación Minera de Taltal—an experimental plant for the treatment of gold, silver, lead and copper sulphate on the friction principle.

THE AUSTRALIAN FOUNDRY JOURNAL, *Castings*, announces the formation of the Institute of South Australian Foundrymen based on Adelaide. The first president is Mr. Hedley Price.

Imposing Bend Casting from Clay Cross

Clay Cross (Iron and Foundries), Limited, Chesterfield, have recently despatched the 84-in. internal dia. casting shown in the illustration. It has a 70 deg. bend, is 7 ft. by 5 ft. with flanges of 8-ft. dia., and weighs about 11 tons. This casting was made to the order of A. Monk & Company, Limited, of Warrington, to the design of the consulting engineers, Rendel, Palmer & Tritton, of London. Together with some 20 others, varying in size from 60- to 96-in. dia., it is to be used in the construction of a new dry dock for Cammell Laird & Company, Limited, at Birkenhead. It is said to be one of the largest pipe castings ever made in this country, and is representative of the type of pipe-work now being produced in the Clay Cross Company's foundries, which have recently been enlarged and re-equipped.

BISF Management College

After several years of experimental work, the British Iron and Steel Federation have established a residential management college at Ashorne Hill, near Leamington Spa. The principal of the College is Mr. G. Smellie, formerly general works manager of the Steel Company of Wales. The JOURNAL'S representative visited the College at the end of the first half of a two-month's course, just before the students returned to the works for a six-week's period. There were then 27 students in residence, all of whom appeared to be in their early thirties. To give an idea of the cross-section of management represented by the students, the following, taken alphabetically, is a list of the positions the first half-dozen occupy in the steel industry:—Assistant superintendent rolling mills; assistant head of costing department; assistant to secretary; assistant manager, No. 4 and 5 blast furnaces, and assistant ironworks manager.

"Star" Lecture

During the afternoon of the first day of the writer's visit, there was given what was probably the "star" lecture, by Sir Robert Shone of the Iron and Steel Board. It was entitled "Efficient, Economic and Adequate Supply under Competitive Conditions" and formed a brilliant survey of current conditions in Europe. It is not too well known that American coking coal costs 85/- per ton delivered to European ports compared with the British price of 110/-. On this factor is based the economy of coastal steel works at Dunkirk, Bremen, Genoa and Stockholm. The "message" of the lecture was to inform these up-and-coming young men of the steel industry, of the major factors influencing their industry.

Ironmaking Group

The next morning was spent at an assessment of Course Technical Project 1, choosing the "ironmaking" group, the assessor of which was Mr. W. Hunter, blast-furnace manager Workington Iron and Steel Company. The scheme the group had worked out, which was presented in the form of a report such as one would expect from a Victoria Street consultant, was highly commended by the assessor, except that he strongly criticized the proposed use of 90 per cent. Durham and 10 per cent. Yorkshire coals for coke making, even though this mixture appeared in the brief. He considered the most important point was the demand that the coke-oven manager must furnish coke with a 90 per cent. shatter index. If this had been done it would have resulted in a much lower capital cost for the project under consideration because such a coke in use has a very high efficiency and much less is used. Thus for the output specified for the year, fewer coke ovens would have had to be built. To attain the high shatter-index, it appears that a number of means are available, amongst which is the admixture with the ground coal of ground coke-breeze, and the like. The assessor also directed attention to the advantages to be derived from the use of sintered ores.

Impressions

As a spectator at this session, the writer was appreciative of and impressed by the sterling worth of the type of work undertaken at the College. It so happens that in certain ministerial circles, the iron and steel and the foundry industry are the "blue-eyed boys" because of the assiduous attention which is being given to training. Common to both industries is the attention devoted to foremen's training courses. They differ, however, in that the foundry industry has established

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a craft training school and a National Foundry College, whilst the steel industry has established their Management Training College. It would appear unnecessary for founders to follow this lead as the existing system within the industry is in every way adequate. However, the sending of a young foundryman to take this course and the making of a report on it available to founders generally would be well worthwhile and relatively inexpensive.

Athlone Fellowship Scheme

Forty young Canadian engineers, mostly graduates direct from Canadian universities, recently arrived in the United Kingdom under the Athlone Fellowship scheme. Their first stay was in London, when they attended a four-day introductory course at the British Council Overseas Students' Centre, Hanover Street, W.1.

The Athlone Fellowships are of two years' duration, and the scheme is financed by the Board of Trade. The Fellowships are available for works training in United Kingdom industrial organizations, or training with consulting engineers, or post-graduate study in a United Kingdom university, college or research establishment, or a combination of any of these.

The objective of the scheme is to enable selected Canadian engineers to obtain first-hand information of the scope and quality of engineering research, development, design and production in the United Kingdom. At the same time the scheme enables the Fellows to meet people in the United Kingdom and become acquainted with their way of life, thus fostering understanding between the two countries. Since the inauguration of the scheme in 1951, about 340 Canadian engineers have been awarded Fellowships.

Land Development Appeals

Joseph Gillott & Sons, steel manufacturers, Sheffield, and Newton Chambers & Company, Limited, have appealed against the refusal of the West Riding Planning Authority to grant permission for the development of two portions of land in the Ecclesfield area for industrial purposes. Joseph Gillott, whose scheme includes expansion of the firm's Hercules works, are seeking permission to use 15 acres at Loicher Lane, Butterthwaite. The land is inside a green-belt area. Newton Chambers plan an industrial estate of about 70 acres of land owned by them, and not in a green belt, at Smith Wood, Ecclesfield.

Sheffield Town Planning Committee, from whom the Planning Authority had sought support in refusing to permit development, took the view that they would prefer the Minister to hold over his decision until discussions had taken place between the Corporation and the West Riding on Sheffield's overspill population. A public enquiry is to be held at Grenoside on October 7.

Industrial Injury Regulations

Effect of Regulations* recently made by Mr. John Boyd Carpenter, Minister of Pensions and National Insurance is that from Monday, September 28, there will be a right of appeal on a point of law from the decisions of medical appeal tribunals to the Industrial Injuries Commissioner, provided that leave to appeal is given, either by the tribunal or the Commissioner. The Regulations bring into operation Section 2 of the Family Allowances and National Insurance Act, 1959.

* National Insurance (Industrial Injuries) (Determination of Claims and Questions) Amendment (No. 2) Regulations, 1959, S.I. 1959 No. 1596, price 4d. from H.M. Stationery Office.

The Institute of Vitreous Enamellers

celebrate their

Silver Jubilee with a Conference and Exhibition

The Institute of Vitreous Enamellers to mark their 25th year of existence organized last week a most successful conference and exhibition, based on the Park Lane Hotel, London, under the presidency of Mr. W. T. Wren. Registrations totalled over 200. The proceedings commenced with the official opening of the conference and exhibition by Mr. R. Reader-Harris, M.P., on Monday evening in the Tudor Room of the Hotel, followed by a reception by the president and Mrs. Wren and the chairman of Council, Mr. J. H. Gray and Mrs. Gray. Later that evening, a Council dinner was held. At this, a presentation of a William-IV silver chalice and salver was made to Mr. W. S. Grainger who had contributed so much to the Institute and who had looked after its financial affairs for a large proportion of its 25 years' existence.

The second day, Tuesday, was spent in works visits by the menfolk and a tour of London by the ladies. Firms inspected—all in the London area—included Belling & Company, Limited, R. & A. Main, Limited, Benjamin Electric, Limited, Lafarge Aluminous Cement Company, Limited, and at all these generous hospitality was offered to the visiting parties. Further works visits on Wednesday were made to British Bath Company, Limited, Aladdin Industries, Limited, General Electric Company, Limited, and the Frigidaire Division of General Motors, Limited. The Tuesday's events concluded with an informal conversazione and dancing, and this item was featured also at the end of the Thursday's programme.

Other social events included a dinner, dance and cabaret show at Quaglino's Ballroom on Wednesday evening, attended by well over 100 delegates and ladies, and a tour of inspection of the Houses of Parliament (with cocktails in the Members' dining room) on the Thursday evening. The week's special programme of events for delegates' ladies took in a fashion show on Wednesday afternoon, an all-day trip by coach to Windsor (including a tour of the Castle) on the Thursday, and a luncheon and floral display in the Dorchester Hotel on Friday.

Annual General Meeting

The annual business meeting of the Institute was held in the Tudor Room of the Park Lane Hotel on Thursday morning, commencing (after the normal introductory items) with the report of the chairman of Council, Mr. J. H. Gray, on the year's activities. This was followed by the statement of accounts, duly audited, and the balance sheet. These, it was explained, showed a small excess of expenditure over income for the year—amounting to about £42—resulting from increased general and administration charges, consequent upon the much-increased activity of the Institute. The accounts were accepted without dissent.

The election of officers followed; Mr. J. W. Gardom proposed—and received full support for—the election of Mr. W. S. Grainger as president-elect. (In the normal course of events, Mr. Grainger will assume office at next year's annual general meeting—scheduled to be held in Birmingham in October. For the three vacancies on the Council, only three nominations had been received and thus election was automatic, resulting in the re-appointment to the Council of Mr. J. H. Gray (Stewart & Gray, Limited), Mr. N. S. C. Millar (Radiation, Limited) and Mr. J. Nicholls (Hurst Hill Enamel Company). The secretary, Mr. J. D. Gardom, was also re-elected. On the proposal of the president, Mr. W. T. Wren, of a vote of thanks to the Chair and its endorsement by members, the formal proceedings were closed.

Awards

The next item on the agenda was the presentation of the two major awards of the Institute. These were the Biddulph Award (open to shop personnel for the best technical contribution to the IVE proceedings during the year on a given subject) and the W. S. Grainger Medal (for significant technical or other services to the Institute). This latter award went to Mr. J. W. Pether (Stewart & Gray, Limited) and the Biddulph Award to Mr. R. Benson (Metal Porcelains, Limited). This was the first occasion on which the Biddulph Award had been presented—it being in respect of Mr. Benson's communication "The IVE 1958 Summer School—a Critical Survey."

Technical Sessions

The technical proceedings of the Conference commenced after the annual meeting with the presentation of the Institute's first Mellor Memorial Lecture. This was given by Professor A. I. Andrews, head of the Ceramic Engineering Department of the University of Illinois, USA, who took for his subject "Developments in Vitreous Enamelling," and dealt with it in masterly fashion, sustaining the full interest of all present. Expressing thanks to the author on behalf of the members at the conclusion of the lecture, Mr. Wren, who was in the chair, said how fitting it was that Professor Andrews had been able to initiate the series, and said tribute was due to the various supply firms in the UK vitreous-enamelling industry who had made possible the financial arrangements necessary for the Professor to come and give the lecture in person. On behalf of the Institute, he then presented to Professor Andrews a silver ornamental vase as a memento of the occasion (this had been donated by

Institute of Vitreous Enamellers

Mr. J. H. Gray). The Professor suitably expressed his thanks to the Institute and his appreciation of the honour of being the first Mellor lecturer, especially as he had such a profound and long-standing admiration for the great chemistry and ceramics pioneer after whom the lecture was named. He also explained earlier that he was in London as the official representative of the American Ceramic Society (the counterpart of the Institute in the US) and brought with him the good wishes of that body for the success of the IVE Jubilee Meeting.

The technical sessions were continued on Thursday afternoon and all day on Friday, when the following contributions were presented and discussed: "Influences of Hydrogen in Vitreous Enamelling of Steel," by Mr. Gordon P. K. Chu (Pfaudler-Permutit Inc., Rochester, N.Y.); "Blistering of Wet-process Vitreous Enamels on Cast Iron —Facts and Theories," by Mr. E. R. Evans, A.I.M., and Mr. A. D. Morgan (British Cast Iron Research Association); "Pinholes and Porosity in Enamelled Cast Iron," by Mr. C. A. Sanders (American Colloid Company); "Control of Furnace Temperatures," by Mr. W. J. Swain (Honeywell-Brown, Limited); "Correct Use of Fuel-oil and Oil-burners," by Mr. G. O. Fenner (Shell-Mex & B.P., Limited); "Refractories," by Mr. D. Dixon (previously with Morgan Crucible Company, Limited); "Methods of Decoration used in the Ceramic Industries," by Dr. W. L. German (College of Ceramics, Stoke-on-Trent); "Critical Assessment of Vitreous Enamel in the Home," by Miss J. E. Walley (Queen Elizabeth College, University of London), and "Effects of Detergents on Vitreous Enamel" (sub-committee's report presented by its chairman, Mr. N. S. C. Millar). A final technical session was held on the Saturday morning, when a paper "Interface Phenomena in Enamels," was presented by Mr. F. Rickmann. The respective chairman of the technical sessions were Mr. J. W. Gardom on Thursday afternoon, Mr. J. H. Gray, Mr. J. Nicholls and Mr. A. Biddulph on Friday morning, Mr. J. H. Gray and Mr. S. E. A. Ryder on Friday afternoon, and Dr. B. K. Niklewski on Saturday morning.

Exhibition

Throughout the whole period of the Conference, there was staged in the hotel (and open to the public) an extremely comprehensive exhibition of enamelled products and materials. This was arranged in three sections, "Vitreous Enamel To-day" in the ballroom foyer; "Artistic Forms of Vitreous Enamel" in the drawing room, and "Vitreous Enamelling Requisites" in the Tudor room (used also for the lectures). These displays were tastefully arranged and contributed much to members' appreciation of each other's spheres of activity and to the success of the Jubilee Meeting proceedings as a whole. During the whole run of the Conference, members were loud in praise of the arrangements, the secretary, Mr. J. D. Gardom, and his colleagues, including the section chairmen and secretaries, being warmly congratulated on the whole organization.

Banquet

The Silver Jubilee banquet of the Institute was held in the ballroom of the Park Lane Hotel on Friday, following a reception in the early evening by the president and Mrs. W. T. Wren and the chairman of Council and Mrs. J. H. Gray. The function was attended by close on 300 members and ladies. Accompanying the president and chairman (and their ladies) at the top table were the Earl of Verulam, Mr. H. E. Wincott, Mr. W. S. Grainger (president designate), Mr. M. J. Glenny (chairman, Council of Ironfoundry Associations), Prof. A. I. Andrews, Mr. C. R. Wheeler, C.B.E. (past-president), Mr. J. Nicholls (vice-chairman of Council), Mr. W. C. F. Hessenberg (deputy director, British Iron & Steel Research Association), Mr. F. H. Clews (president, British Ceramic Society), Mr. J. W. Gardom (past-president), Mr. S. Hallsworth (past-chairman of Council), Mr. H. G. Campbell, Mr. W. Todd (past-chairman of Council), and Mr. G. R. Webster, most of whom were accompanied by their ladies. Mr. Wren who proposed the "Loyal Toast" also responded to the toast to the "Institute and the Vitreous Enamelling Industry," proposed by the Earl of Verulam. Mr. J. H. Gray, chairman of the Council of the Institute, proposed "Our Guests" to which Mr. H. E. Wincott replied. The proceedings continued with light entertainment and dancing until 1 a.m.

Veritys' Works Sold

The various departments of Veritys, Limited, the Birmingham manufacturing electrical engineers, for which a receiver was appointed earlier in the year, have now been sold. The controller and switchgear department has been taken over by William McGeoch & Company, Limited, Glasgow, while the Brush Group, Limited, London, S.W.1, has acquired the motor section. The fan department has been bought by the Limit Engineering Company, Limited, group, London, N.1.

F. & C. Osler, Limited, Birmingham, and William McGeoch & Company have merged to purchase the entire lighting manufacturing section of Veritys. The new firm of McGeoch, Osler & Veritys, Limited, will commence production next month. Joint managing directors will be Mr. A. Stewart, managing director of William McGeoch & Company, and Mr. W. T. Grant, formerly of Veritys.

Exports to Argentina

Recent legislation passed by the Government of Argentina is stated to be cutting the countries of the European Coal and Steel Community out of what has for long been a traditional market. The Government has passed a special law under which certain imports from the country's South American neighbours will be freed from duty and taxes.

As a result offers of Chilean and Brazilian sheet metal and Brazilian billets are flooding the Argentine market. To this situation is added the recent large-scale export of pig-iron and other products from South Africa. The stage has now been reached where European exports to the Argentine are virtually only of special types or measurements not obtainable from South America itself.

American Letter

Pinholing due to Bonding Clays *

About four years ago, at a meeting of foundrymen, it was discovered that several of the foundries (producing malleable iron) represented had seldom if ever experienced pinholing, whereas other foundries (producing similar castings) in the same area were periodically plagued with this defect. The fact that the foundries without pinhole problems each used an illite clay bond was not recognized as significant at that time.

Research on Various Bonds

Foundry A was experiencing a particularly heavy incidence of pinholes—Foundry B reported no pinhole difficulties. It was decided to cast moulds made with Foundry A's sand with metal from Foundry B. The castings produced contained pinholes. Metal from the same melt, cast in Foundry B's sand, produced no pinholing. Metal *melted in Foundry A* was then used with two sands, and the results, no pinholing with Foundry B's sand, confirmed that Foundry A's sand was at fault. Foundry A then proceeded to duplicate Foundry B's sand. One ingredient at a time was changed, with no benefit, until at last the clay bond was changed to illite, whereupon the pinholing ceased. More research revealed that pinholing occurs much less often when illite, rather than other clay bonds, is used. A set of thermal curves was made showing the difference in gas evolution when the bonding clays in question were heated. The curves (see Fig. 1) show slight and gradual evolution of water vapour from illite, but large expulsion of water vapour at low temperatures from the bentonites. The authors consider this to be very significant.

Mould-drying Experiment

In a further experiment, a pattern was selected and two moulds made, the cope and drag pattern surface of each mould being faced with southern-bentonite bonded sand. One of the moulds was torch-dried on both cope and drag surfaces, the other mould was not dried at all—the mould that was dried did not reach the crumbly state. A thermocouple placed ¼ in. from the mould surface indicated a temperature of only 70 deg. C. during the torch drying. Since the temperature of the flame was over 540 deg. C. it is safe to assume that all of the free water was removed. When the torch was left in one place too long the sand surface would lose its bond, and crumble, indicating that the clay was calcined. It is reasonably certain that none of the chemically-combined water was removed.

The castings made in the flame-dried mould showed no evidence of pinholes, whereas the castings made in the undried mould were pinholed. This work confirmed a test made by a large national concern that has made a study of pinholing in malleable-iron and aluminium castings. This concern was able to eliminate pinholing on all but the heaviest-sectioned castings when an illite-bonded sand was used. When using other clay bonds, they found it necessary to increase the coal-dust addition up to 12 per cent., as the section thickness of the casting increased up to 5 in.

Conclusions

The authors concluded that pinholing in malleable castings is often caused by the evolution of water vapour from certain clay bonds in green-sand moulds, when they are heated above 100 deg. C. by molten iron. It has been demonstrated that certain clay bonds used in green-sand moulding, when heated, emit a smaller volume of water vapour, at a slower rate, than other bonds. In many cases pinholing may be avoided by using these clays. When a mould is dried, the absence of water vapour ensures a pinhole-free casting in most cases. Furthermore, when coal-dust is used in sufficient quantity in green-sand moulds, the possibility of pinhole formation is reduced, no matter what clay bond is used. Therefore, a reduction of pinholing in malleable castings can be obtained by:

(1) Selecting a clay bond with a low water-vapour evolution, (2) pre-drying the mould, (3) increasing the seacoal content, and (4) removing hydrogen gas from metal prior to pouring.

* From work done by D. R. Jones (assistant sales manager, Illinois Clay Products Co.), and R. E. Grim (professor of geology, University of Illinois).

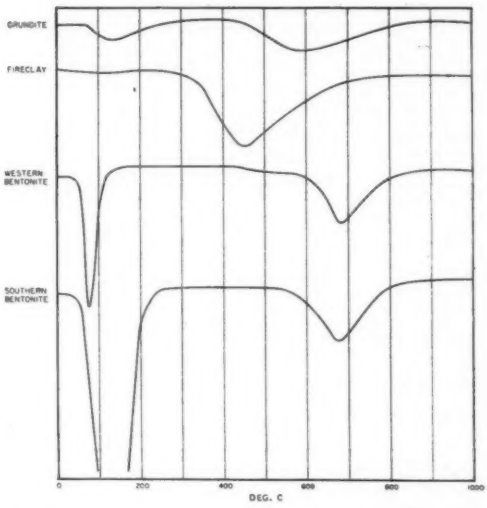

FIG. 1.—*Thermal curves of various bonding clays, showing variations in water-vapour evolution.*

Rise Predicted in Grey-iron Castings Output

Grey- and ductile-iron casting deliveries in 1959 are expected to better 1958 shipments by approximately 30 per cent., according to a prediction by Donald H. Workman, executive vice-president of the Gray Iron Founders' Society. After a steeper decline in the last quarter of 1957 the downward trend actually reversed itself in April of 1958, but a full recovery was not experienced until the first quarter of this year. With current trends up strongly, the Society anticipates deliveries of 13.5 million tons this year. The 1958 total of 10.4 million tons delivered was the industry's poorest since 1946.

LAST MONDAY the Worshipful Company of Founders held their annual service at Saint Margaret's Church, Lothbury, the lesson being read by the Master, Mr. G. W. Ilsley, A.C.A. After the service, the Livery met for luncheon at the Wellington, the ship which is the headquarters of the Hon. Company of Master Mariners. Luncheon was followed by a meeting of the court, who elected Mr. A. C. Jennings, M.A. as Master for the year 1959.

British Blast Furnaces in the June Quarter, 1959

(These tables are published through the courtesy of the British Iron and Steel Federation.)

Derbyshire, Leicestershire, Notts, Northants, and Essex.

Name of firm.	In blast at end of the second quarter, 1959.					Weekly average in blast.	Total existing at end of quarter.
	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.		
Ford Motor	1	—	—	—	1	1	1
Holwell Iron	—	—	2	—	2	2	4
Kettering Iron & Coal	—	—	—	—	—	—	2
Renishaw Iron	—	1	1	—	2	2	2
Sheepbridge	—	1	1	—	2	2	2
Stanton Ironworks: Stanton-by-Dale	—	1	2	—	3	4	5
Staveley Iron & Chemical	—	—	3	—	3	3	4
Stewarts and Lloyds: Corby	—	3	—	—	3	3.8	4
Wellingboro' Iron	—	1	—	—	1	1	3
TOTAL	1	7	9	—	17	18.8	27

Lancashire (excl. N.-W. Coast), Denbighshire, Flintshire, and Cheshire.

Brymbo Steel Works	—	1	—	—	1	1	1
Darwen & Mostyn Iron	—	—	—	1	1	1	2
Lancashire Steel Manufacturing	—	2	—	1	3	3	3
Summers, John	—	2	—	—	2	2	2
TOTAL	—	5	—	2	7	7	8

North-West Coast.

Barrow Ironworks	1	—	—	—	1	1	4
Charcoal Iron	—	—	1	—	1	1	1
Millom Hematite Ore & Iron	2	—	—	—	2	2	2
United Steel: Workington	2	—	—	1	3	3	3
TOTAL	5	—	1	1	7	7	10

Lincolnshire.

Appleby-Frodingham Steel	—	3	—	—	3	3	4
Lysaght's Scunthorpe Works	—	3	—	—	3	3	3
Thomas, R., & Baldwins: Redbourn	—	2	—	—	2	2	3
TOTAL	—	8	—	—	8	8	10

North-East Coast.

Consett Iron	—	2	—	—	2	2	3
Dorman Long (Steel): Acklam	—	2	—	—	2	2	4
Redcar	—	—	—	—	—	—	2
Bessemer	—	—	—	1	1	1	2
Clay Lane	—	2	—	—	2	2	2
Gjers, Mills	2	—	—	—	2	2	3
Normanby Iron Works	2	—	—	—	2	2	3
Skinningrove Iron	—	2	—	—	2	2	3
South Durham Steel & Iron: West Hartlepool	—	2	—	—	2	2	3
Cargo Fleet	—	2	—	—	2	2	3
TOTAL	4	12	—	1	17	17	28

Scotland.

Bairds & Scottish Steel: Gartsherrie	—	2	—	—	2	2.8	3
Carron	—	—	1	—	1	1	4
Colvilles: Clyde Iron Works	—	1	—	—	1	1	3
Ravenscraig	—	1	—	—	1	1	1
Dixon's Ironworks	—	—	—	—	—	—	6
TOTAL	—	4	1	—	5	5.8	17

South Wales and Monmouthshire.

Guest Keen Iron & Steel: Cardiff	1	2	—	—	3	3	4
Thomas, R., & Baldwins: Ebbw Vale	—	3	—	—	3	3	3
Steel Company of Wales: Margam	—	4	—	—	4	3.6	5
TOTAL	1	3	—	—	10	9.6	12

"Castings for USA"

The Board of Trade, under "Export Opportunities," record that they have been advised by the British Consulate at Portland, Oregon, that the Willamette Iron & Steel Company of Portland require information about United Kingdom firms able to produce iron, steel and stainless-steel castings. The American firm are anxious to make contact with United Kingdom firms who would be prepared to submit quotations for castings, or quantities of castings, against bids received by the USA firm in connection with tenders put out by such concerns as the Corps of Engineers, Bonnefield Power Administration and the Bureau of Reclamation, etc. It is understood that recent tenders have been issued for dam-lifting gates, sluices and material for hydro-electric projects.

United Kingdom firms interested in doing business with the American firm are asked to let Willamette know their experience in producing to US specifications, their production range in weight limits, approximate capacity and, preferably, should give the name of a specific individual. Correspondence should be addressed to Mr. K. J. Wittkop, purchasing department, Willamette Iron & Steel Company, 2800 N.W. Front Street, Portland, Oregon.

[The Willamette company started in 1918, and have for years maintained a position of prominence throughout the Pacific Coast. UK firms responding to this invitation should send copies of their initial correspondence to the British Consulate, 907 Lewis Building, Portland 4, Oregon.]

BCIRA Lectures

The British Cast Iron Research Association, jointly with the Metallurgy Department of the Royal College of Science and Technology, Glasgow, has organized a series of lectures to be given in Glasgow at the Royal College during October to December. This course of lectures, under the title "Cast Iron as an Engineering Material" is intended primarily for the engineer and designer: it aims to instruct or reinform them on the metallurgy and properties of the material and to indicate correct principles of design from the aspect of both the foundryman and the user of the casting.

Two lectures will be given on each successive Thursday afternoon from October 22 to December 3. With one exception, the lectures will be undertaken by BCIRA staff. Enrolment forms can be obtained from the secretary, the Royal College of Science and Technology, Glasgow, C.1, and the enrolment fee is £3 3s. 0d. for the course of 14 lectures.

Progress in Training Technologists

This country is now moving very fast towards its immediate aim of doubling the output of scientists and technologists by the late 1960s, said the Minister of Education, Mr. Geoffrey Lloyd. He was speakjng at the official opening on September 16 of extensions to Rugby College of Technology and Arts.

New technical college buildings were now being opened at the rate of one a week, sandwich courses had increased from about 70 in 1955 to more than 300 in the present session, and the intake of students to advanced courses had increased by more than 700 per cent. since 1956.

Earlier in the day the Minister visited the Rugby works of the British Thomson-Houston Company, Limited, to open its new education building. He was greeted by Lord Chandos, chairman of the parent company, Associated Electrical Industries, Limited. Because there was not enough time for Mr. Lloyd to meet apprentices at work in the factory arrangements were made for him to see them by means of a closed television circuit.

BTH has more than 2,000 apprentices, including 333 students, 146 graduates, and 150 who are taking the sandwich course at the college.

British Blast Furnaces in the June Quarter, 1959—*continued*

Staffordshire, Shropshire, Worcestershire, and Warwickshire.

Name of firm.	In blast at end of second quarter, 1959.					Weekly average in blast.	Total existing at end of quarter.
	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.		
Goldendale Iron	—	—	1	—	1	1	2
Lilleshall Iron & Steel	—	—	—	—	—	—	2
Shelton Iron & Steel	—	2	—	—	2	2	3
Stewarts and Lloyds: Bilston	—	1	—	—	1	1	2
TOTAL	—	3	1	—	4	4	9
Sheffield.							
Park Gate Iron & Steel	—	2	—	—	2	2	2
GRAND TOTAL	11	50	12	4	77	79.2	123

Weekly Average Number of Furnaces in Blast during the June Quarter, 1959, and the Previous Four Quarters

District.	1958.			1959.	
	June.	Sept.	Dec.	March.	June.
Derby, Leics., Notts., Northants, and Essex	21	19.2	20	20	18.8
Lancs. (excl. N.-W. Coast), Denbigh, Flint, and Ches.	6.4	7	6.9	6.9	7
Lincolnshire	9.6	9.1	9.5	8	8
North-East Coast	19.2	17.7	18	17.4	17
Scotland	8.9	7	6.7	6	5.8
Staffs., Shrops., Worcs., and Warwicks.	5	5	5	4.9	4
South Wales and Monmouth	10.9	10.9	10.4	9.5	9.6
Sheffield	2	2	2	2	2
North-West Coast	7.8	5.7	6	7.4	7
TOTAL	90.8	83.6	84.5	82.1	79.2

The following companies have furnaces in course of construction or rebuilding:—Lancashire Steel Manufacturing; Millom Hematite Ore & Iron; South Durham Steel & Iron (West Hartlepool); J. Lysaght's Scunthorpe Works; Bairds & Scottish Steel.

EEC Equipment for Rolling Mills

Engineered and mainly manufactured at the Stafford Works of the English Electric Company, Limited, equipment worth over £1,000,000 has recently gone into service in four new rolling mills in the Midlands. Two are at Patent Shaft Steel Works, Limited, Wednesbury (Staffs), and the other two are at the Bilston (Staffs) works of Stewarts and Lloyds, Limited. The major part of the electrical engineering in all four mills, which are of the hot-reversing type, was carried out by the metal industries division of English Electric.

At the Patent Shaft Steel Works, the 38-in. blooming and slabbing mill and the 54-in. by 32-in./98-in. four-high plate mills each have a 5,000-b.h.p. (r.m.s.) main drive motor, with a speed range of 45 to 90 r.p.m. and a cut-out torque of 240 metre-tons. Both drives are identical and are fed from identical Ilgner sets. The contract also covered all the Ward Leonard auxiliary motors, the motor generator sets, the control gear, and the ventilation and lubrication equipment for the mill.

For the 40-in. blooming and the 32-in. roughing mills at Stewarts and Lloyds, English Electric supplied two identical main drives—5,600-b.h.p. (r.m.s.) motors, with speed ranges of 50-120 r.p.m. and cut-out torques of 240 metre-tons. Ingots from the melting shop are rolled into blooms on the 40-in. mill and round bars or square billets are produced on the 32-in. mill.

ADA (HALIFAX), LIMITED—Mr. D. E. Aslen has been appointed to the board.

News in Brief

DAVY AND UNITED ENGINEERING, LIMITED, Sheffield, held an "open day" at their Darnall works on September 19, when each employee was permitted to bring three guests and there were over 3,000 acceptances.

THE LONDON AREA SALES OFFICE of Northern Aluminium Company, Limited has removed, from Bush House to new premises at 50, Eastbourne Terrace, London, W.2 (Telephone: PADdington 3281).

WATTS CHEMICALS, LIMITED, will shortly be moving to more modern offices, and as from September 21 all communications should be addressed to: Friendly House, 24, Chiswell Street, London, E.C.1 (telephone: MONarch 2642).

TWENTY-NINE SENIOR BOYS from 21 public schools attended, from September 7 to 12, the first of two short courses on iron and steel production, research and management, being held by the United Steel Companies Limited, Sheffield.

THE CANADIAN steel industry produced 451,277 tons of steel ingots in August, compared with 265,698 tons in August, 1958. Total for the first eight months of this year was 3,700,228 tons, against 2,952,581 tons in the corresponding period of last year.

ROLLS-ROYCE, LIMITED, Derby, have presented Sheffield City Libraries with a £50 microfilm reader in gratitude for "excellent services." Over the last three or four years, the libraries have been able to lend the firm British and American atomic-energy reports.

EFCO, LIMITED, are building another factory in the LCC industrial development area at Sheerwater, near Woking, in Surrey. The new factory, scheduled for completion early next year, will provide up-to-date facilities for the manufacture of special furnaces.

TWO 33,000-TON TANKERS are being built in Fairfield, Scotland, for the Cía. Shell de Venezuela. Total cost will be approximately £5,000,000. The first was due to be launched this month and the second is expected to be launched towards the middle of next year.

THE PRODUCTION OF SPRINGS at the old-established firm of W. Griffith & Sons, Limited, of Brightside Lane, Sheffield, is due to cease shortly as its railway-spring-making business and certain items of plant have been acquired by English Steel Spring Corporation, Limited.

THE GLASGOW FOUNDRY of Alley & MacLellan (Polmadie), Limited, manufacturers of air and gas compressors and vacuum pumps, etc., is to be run down and will be closed by the end of October. It is hoped to absorb a few of the 70 workers in the company's Jessie Street, Glasgow, works.

THE DATE for the first exhibition of the Atomic Energy Authority Display at Sheffield has now been settled for the week from November 6 to 14. Accommodation problems have been solved by the authorization of Sheffield Museums Committee for the use of two galleries of the City Museum.

LORD DUDLEY GORDON, chairman of Hadfields, Limited, distributed £200 in prizes to apprentices on September 18. Mr. William Carron, AEU national president, who presented the certificates, told the apprentices that "In this age of rapidly expanding technology craftsmen would be needed as never before."

RENFREWSHIRE VALUATION APPEAL COURT, sitting at Paisley on September 16, allowed industrial derating on the research station of Babcock & Wilcox, Limited, at High Street, Renfrew. The assessor intimated an appeal. He proposed an assessment of £4,090, but the Court decided that the firm should pay rates on a sum of about £2,000.

AT A DINNER given by Broom & Wade, High Wycombe, Bucks, to members of their Quarter Century Club, now numbering 102, no fewer than 50 gold watches were presented. A special guest was Miss E. Isaksen of Oslo, who for more than 25 years has been with Ronneberg, Hansen & Company, the firm's Norwegian agents.

THE EDINBURGH FIRM of Bruce Peebles & Company, Limited, electrical engineers, are shortly to receive an order for transformers, valued at between £300,000 and £400,000, to be used in the power distribution system of Victoria, Australia. This will be the second big order of its kind from Australia to be undertaken by the firm in the past two years.

THE FORTH BANK LOCOMOTIVE WORKS, Newcastle-upon-Tyne, believed to be the oldest works of its kind in the world, are to be closed down when present contracts are completed. Robert Stephenson & Hawthorns, Limited, the proprietors, state that during the past three years, steam locomotive business at the works has fallen away completely.

ONE OF TWO new 4,900-gross-ton cargo ships which were to have been built by the Burntisland Shipbuilding Company, Limited, for the Prince Line (a member of the Furness, Withy, Limited, group), has been cancelled and the Prince Line is to withdraw its three remaining vessels in the US-Far Eastern trade from that service "owing to increasing operating costs and intensive competition."

THE US General Electric Company has received official permission to go ahead with the construction of four turbine generators for a dam project at Barkley, Kentucky, in spite of the bid of $4,500,000 (£1,600,000) by the English Electric Export & Trading Company, Limited, which was $68,000 less than the American tender. The reason given was that the British bid was "not up to specifications."

BOTH Colvilles, Limited, and Richard Thomas & Baldwins, Limited, have announced their intention to make steel, equivalent to open-hearth quality, by the new "L.D." mass-oxygen process, and it remains to be seen which of the two will be the first in Britain to produce quantity steel in this way. Colvilles, who were the first to make their intentions public, had development on these lines in mind when planning the Ravenscraig works five years ago.

HOME AND EXPORT sales departments of David Brown Construction Equipment, Limited, have been moved from Hanworth Park, Feltham (Middx), to the main David Brown tractor factory at Meltham Mills, near Huddersfield. The northern parts and service depot has been transferred from Mill Springs, Netherton, to the main David Brown parts and service factory at Scarr Bottom, near Huddersfield. The parts and service depot at Hanworth Park is being retained to serve customers in the south.

OVERSEA SERVICE announces a residential introductory course on "The Caribbean" (designed for men and women who are going out to Caribbean territories for the first time) to be held at Dunford, Midhurst, Sussex, from November 16 to 20. In order that the programme may be adapted to suit the needs of those attending the course, early applications would be appreciated, giving, if possible, the expected destination of the nominees. Applications should be made to the London office at 2, Eaton Gate, S.W.1.

(Continued on page 226)

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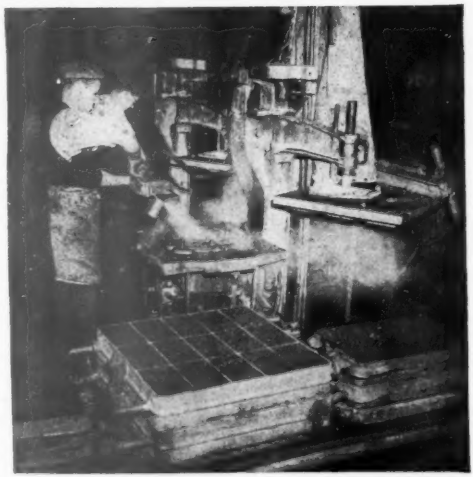

Illustrations of "PLP" in use by courtesy of Messrs. Henry Wallwork & Co., Ltd., Red Bank, Manchester.

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FOUNDRY & METALLURGICAL F&M S.L.

News in Brief

(Continued from page 224)

MR. HERBERT MORLEY, general works manager, Samuel Fox & Company, Limited, Stocksbridge, Sheffield, told 600 retired employees at their reunion tea at Stocksbridge Victory Hall on September 19, that the firm's order books were full to "bursting." He also said that the firm was prepared to take its share of the large number of boys now leaving school, and the company would develop its training facilities. Mr. B. Butcher, director and head of the works social services executive, who sponsored the occasion, was chairman.

IT IS REPORTED that property values in Southern Rhodesia's growing steel centre of Que Que have more than doubled since 1951, and figures show that in the last 14 years they have increased from under a quarter-of-a-million to nearly three-million pounds. After a lapse of eight years a complete re-valuation recently carried out shows there has been a total increase of £1,596,710, bringing the 1959 valuation roll up to £2,902,340. The increase in the value of improvements during these years is £1,341,505.

THE DETAIL DESIGN BUYING AND ACCOUNTS DEPARTMENTS of Acme Conveyor, Limited, have been transferred to 58/62, Seaward Street, Glasgow, S.1. The move has been made to bring about better and more centralized co-ordination with the works at Hillington Industrial Estates, Glasgow. The company's technical sales and projects departments will continue to be administered from Acme Chambers, 1, Bradford Street, Walsall, as will also Acme Ventilating, Limited. Additional sales offices are to be opened in due course in other areas.

BY THE TERMS of a recent agreement with Whessoe, Limited, Darlington, Norman J. Hurll & Company (Victoria) Pty., Limited, of Melbourne, Australia, and Christchurch, New Zealand, is able to offer the complete range of Whessoe gas plant in Australia and New Zealand, apart from W.W-D. electro-detarrers which Woodall-Duckham (Australasia) Pty., Limited, Melbourne, will continue to supply. The company will act as licencees, arrange Australian manufacture, and carry out contracts for plant to Whessoe designs and guarantees.

YORKSHIRE INDUSTRIAL FIRE BRIGADES ASSOCIATION held its conference at Scarborough on September 19, under the chairmanship of Mr. John R. Brewster, when delegates were welcomed by the deputy mayor, Councillor G. F. Hodgson. Papers were given by Mr. L. N. Duguid, deputy chief inspector of factories, on the new Factories Act; Mr. A. P. Backshelf on the origin, uses and hazards of industrial solvents; Mr. L. A. Ashton, department of Scientific and Industrial Research, on the Thermal Insulation (Industrial Implications) Act; and Mr. H. Powell, principal scientific officer, Home Office Forensic Laboratory, North Eastern area.

THE NORTH THAMES GAS BOARD, serving over 1,000 sq. miles in and around London, has ordered 12 special multipurpose vehicles from Albion Motors, Limited, of Glasgow. The Board has already much operational experience with alternative tipper-platform bodies for each chassis, and now proposes to go one stage further by ordering chassis on to which any one of three alternative bodies can be mounted, *viz.*, platform, tipper or box. The platform and box bodies will be supplied by the Redhill Bodybuilding Industries, Limited, whilst the tipping bodies, together with Anthony hoist tipping gear, will be provided by the Steadman Engineering Company, Limited.

Obituary

Mr. SAMUEL ARTHUR WOODWARD, a former partner in Edward Barnett & Company, engineers and founders, of Walsall (Staffs), has died at the age of 85. The business is now carried on by one of his sons.

The death occurred on September 17 of Mr. THOMAS WALKER SYKES, commercial superintendent of David Brown Industries, Limited, Park Works, Huddersfield. Aged 62, he had been with the firm for over 45 years.

The death took place suddenly on Friday, September 18, of Mr. W. T. LAVERTON, a director of Robert Hyde & Son, Limited, of Stoke-on-Trent and Chesterfield. He was 67. Mr. Laverton who joined the company in 1930, retired from active work in 1953, but still retained his directorship of the company. In addition he was a director of Robert Hyde Investments, Limited.

The death is announced of Mr. E. L. N. VAN LOO, who was manager of the industrial division of H. Englebert, N.V., Voorsschoten, distributors of NCK cranes and excavators in Holland. He was primarily responsible for the sale of the machines made at Thorncliffe, headquarters of Newton, Chambers & Company, Limited, which he had visited several times. When that company took over Ransomes & Rapier, Limited, last year, he represented the NCK Rapier Sales Company, Limited, which was formed subsequently. Mr. Van Loo was 50.

Recent Wills

Gross estate of Sir Frederick Pickworth, chairman of the English Steel Corporation, Limited, and of its principal subsidiary companies, amounted to £66,808. Net value of his estate was £64,576 and the duty amounted to £24,946.

Sir Frederick, who was 69, collapsed and died shortly after speaking at a dinner in Darlington on July 14 given in recognition of his chairmanship of Darlington Forge, Limited, an appointment he relinquished in 1957 when he became Master Cutler. He was also a director of Vickers, Limited, and of many other companies.

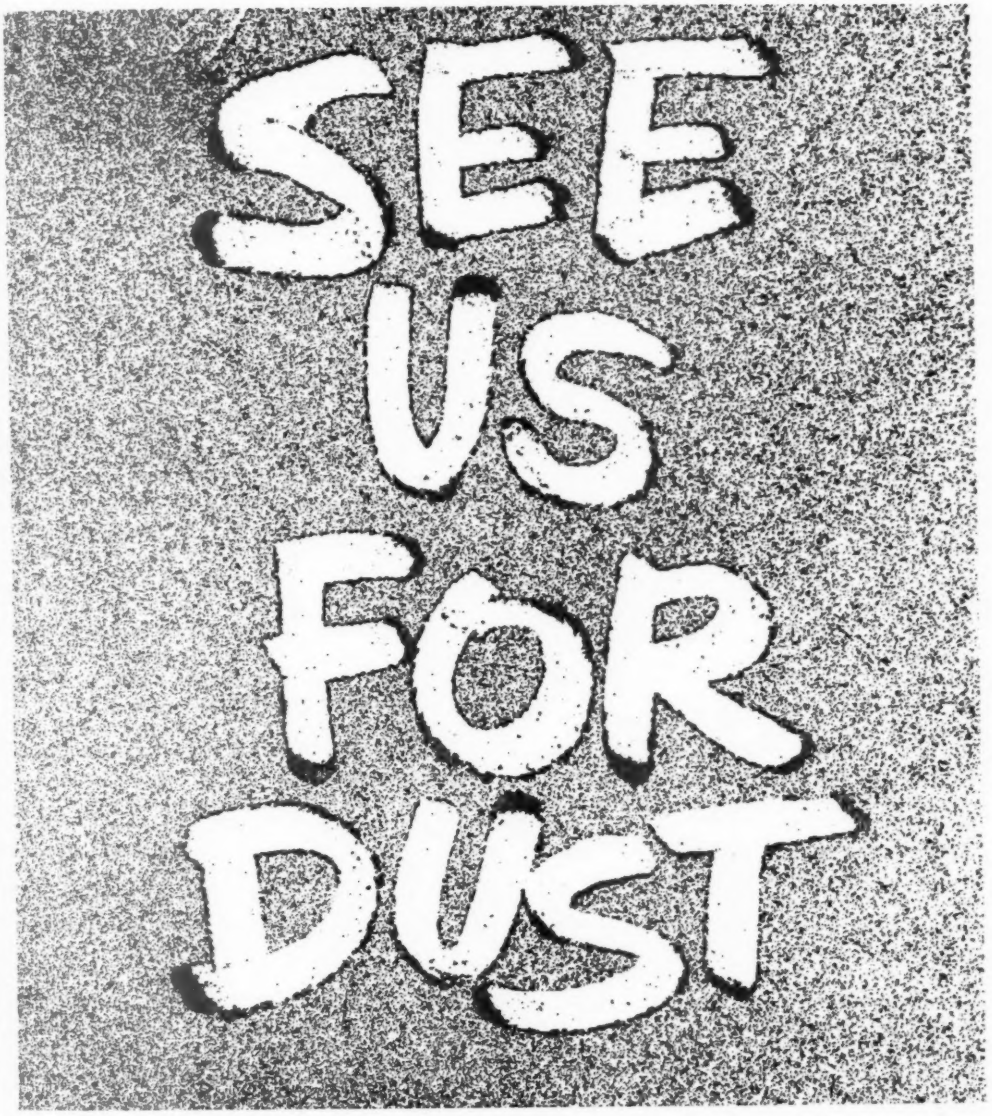
KAY, J. G., chairman of the Lafarge Aluminous Cement Company, Limited, London, W.1, and a director of other companies £29,734

BROWETT, SIR LEONARD, director of the National Union of Manufacturers, 1945-53, a director of Super Oil Seals & Gaskets, Limited, King's Norton, Birmingham £10,904

RUSHWORTH, C. D., a director of Rushworth & Company (Sowerby Bridge), Limited, machine-tool makers, of Sowerby Bridge (Yorks), Graham & Normanton, Limited, machine-tool makers, of Halifax, Darling & Sellers, Limited, machine-tool makers, of Keighley (Yorks), and A. Kinghorn & Company, Limited, machine-tool makers, of Todmorden (Lancs) £60,134

Latest Foundry Statistics

Ironfounding: The Council of Ironfoundry Associations states that 122,689 ironfoundry workers were employed in the United Kingdom during the week ending August 1, of whom 8,327 were females. The July 4 total was 123,251 and for August, 1958, it was 131,061.



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Raw Material Markets

Iron and Steel

Production of pig-iron is maintained at recent levels. Although in all grades capacity is not fully employed, outputs are more than sufficient to meet the present needs of all consumers. The average weekly rate of production is in the region of 220,000 to 230,000 tons and over the last 12 months there has been no appreciable variation from this figure. Expansion in overall consumption is slow for most grades of pig-iron. Many producers continue to find difficulty in disposing of their full outputs, while the fairly substantial stocks held by them show no material decline, apart from the stocks of high-phosphorus pig-iron; these have been reduced mainly by the export business received recently. The increased outputs at the steelworks have called for larger tonnages of basic pig-iron, but these have not been as large as expected due to the increased usage of scrap, which is also being utilized in larger quantities by many foundries in their mixtures at the expense of pig-iron. With the present state of the market and the ability of most producers of pig-iron to effect prompt delivery from stocks, buyers continue to specify only those tonnages which are required for immediate consumption.

The engineering and speciality foundries maintain their comparative supremacy in the production of castings compared with other types of foundries. Overall demands for high-quality castings are appreciable, with the motor vehicle trade the main consumer. That trade's schedule of requirements shows an increase on recent demands in many instances, and the foundries concerned are able to obtain satisfactory outputs. Some recovery in business has been made by the machine-tool industry and this has in turn benefited the foundries.

At the light-castings foundries the improved demand from the domestic utensil and building trades enables them to continue their improved production, but much more work could be undertaken, and this also applies to the jobbing and textile foundries, which are only moderately employed.

All foundries have no difficulty in obtaining the pig-iron they need. Low-phosphorus irons continue to be taken up in appreciable quantities and the increased tonnages of this grade now available are adequate to cover requirements. Hematite is plentiful and refined irons, when required, can be obtained without difficulty.

Increased activity continues at the re-rolling mills, and there is a substantial demand for small bars and light sections, and also for reinforcing rods, the re-rollers of which are very busy. The call for steel semis continues to expand, and most home steelworks are committed for their outputs for some time ahead. The re-rollers have meagre stocks on hand, as these had been kept at a low level, and difficulty is now being experienced in obtaining the billets and blooms required to undertake the urgent orders on hand. There is also a strong demand for arisings of suitable defectives and crops.

Non-ferrous Metals

The sharp drop in stocks of refined copper held in London Metal Exchange official warehouses last week appears to have put a "bottom" to the recent downward trend of prices. The fall in stocks totalled 1,850 tons, leaving total stocks at 12,813 tons, the lowest level since the week ended May 23, 1959. This decline is attributed to shipments made to the United States which have been taking place over the last three weeks, and underlines the present situation in America, where 75 per cent. of production capacity is still strikebound. Indeed, apart from one or two abortive overtures, labour and management are still as far apart as before and the fast hardening belief now is that the present strike will continue well into October.

At least 100,000 tons have already been lost by the strike and it is reported that stocks in US producers' hands are now down to 92,175 tons. It is therefore important to bear in mind that a continuation of the strike for very much longer must soon reflect itself in the price structure. This point can be stressed if the longshoremen come out on strike, thereby blocking out any chance of relief supplies pouring in from outside America.

In the US, the custom smelters' quotation of 33 cents a pound still stands, as does the producers' price of 31½ cents a pound. In the UK, the price seems to have grounded and, all points considered, the undertone is now firm enough to support a rising trend of prices. This could be well triggered off if the present contract negotiations taking place between Braden Copper and the labour unions in Chile break down. It is, however, expected that these negotiations will be successful. On the other hand, the Braden mineworkers have voted on a legal strike to take place next Thursday.

Tin is still ploughing a steady furrow. The recent increase in the export quotas has had no visible impact on the market, and with demand better from the United States and from the Continent, it is believed that the buffer stock manager has been selling tin to keep the price down around its present level. The Eastern quotation is not as buoyant as it has been recently. Stocks of tin in LME warehouses rose last week by 23 tons to 8,560 tons, the distribution being 4,839 tons in London, 3,561 tons in Liverpool, and 160 tons in Hull. In the US demand is improving and the price is not far short of $1.03 a pound.

Lead has been a reasonably good market, but there is too much metal about for this low level demand to influence the price, which is now struggling hard to keep up to £70 a ton. In the US, the market is featureless and the price is 13 cents a pound.

Zinc, which has been a good market for months on both sides of the Atlantic, has, at last, been rewarded by an advance of 1 cent to 12 cents a pound, with electrolytic special high grade being quoted at 13¼ cents a pound. The market in London remains firm, with metal not too easy to find at times.

House Organ

Newsletter, Vol. 11, No. 3. Issued by the David Brown group of companies.

The Editor of this house organ has indeed a difficult task, as his readers are distributed over quite a number of works. He rightly stresses the major events of interest to all the staff—and the general public also—and reserves purely local news to the stating of a few facts. Very obviously pride of place in the articles is given to the Aston Martin racing-car victories—for these cars gained first and second place at the Le Mans meeting. Also in the magazine is a note about the demolition of the historic clock mill at Meltham. It seems vandalism to the reviewer to allow a clock which has given good service for 180 years to crash to the ground: surely it might have been accorded a decent funeral? During a visit by the Manchester Diocesan Industrial Chaplaincy to the David Brown Jackson works, the neophyte clergy were lectured by Mr. G. L. Hancock, general manager of the foundry division, thus reversing the usual order of things!

Personal

Mr. J. T. RUFFER has been appointed chairman of the Lafarge Aluminous Cement Company, Limited, in place of the late Mr. J. G. KAY.

Mr. F. W. JAMES and Mr. K. R. H. JAMES have been appointed assistant managing directors of the Wolverhampton Metal Company, Limited.

Miss ELIZABETH COX, a member of the publicity department of the Carron Company, Falkirk, who are celebrating their 200th anniversary this year, has been chosen "Bicentenary Belle."

Mr. G. J. LYONS has been appointed secretary of the Institution of Plant Engineers in succession to Mr. R. F. FARMER who has resigned to take up an appointment with the Institute of Civil Engineers.

Mr. COLIN LESLIE FORBES has been appointed assistant managing director, and Mr. G. KERSHAW has been elected a director of Greenwood and Batley, Limited, engineers, Armley, Leeds.

Twiflex Couplings, Limited, The Green, Twickenham, Middlesex, a member company of the Sheepbridge Engineering Group, announce the appointment of Mr. D. POOLEY as their southern-area engineer.

Mr. ARTHUR G. DAVIS, sales director of Edwin Showell & Sons, Limited, brassfounders, Stirchley Brass Foundry, near Birmingham, for the past three years, has retired after 50 years' association with the company.

Following the appointment of Mr. R. W. KNEESHAW as managing director of Atlas Copco (NZ), Limited, Mr. K. G. C. NICHOLLS has been appointed manager of the Walsall branch of Atlas Copco (GB), Limited, in his place.

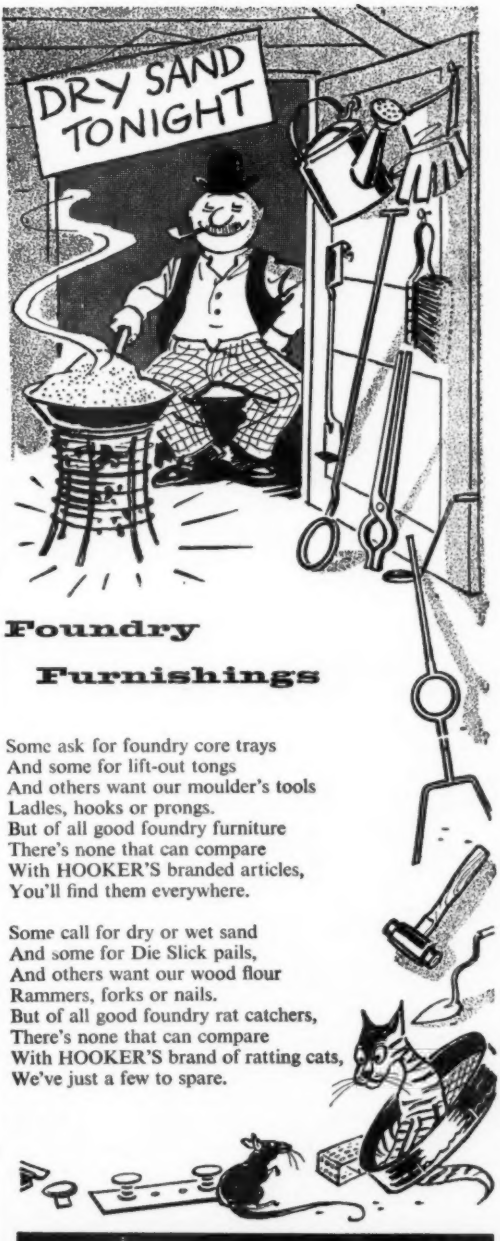
Mr. MICHAEL J. STOCKWELL has been elected a director and Mr. GEOFFREY B. HILTON appointed general manager of H. Stockwell & Company, Limited, iron and steel merchants and stockholders, Trafford Park, Manchester.

Crofts (Engineers), Limited, of Bradford, Yorks, announce the appointment of two additional representatives for the London area:—Mr. L. C. BLAKE and Mr. A. E. PEGGS, both of whom will operate from 34, Norfolk Street, Strand, W.C.2.

Mr. P. RUSHWORTH, director and secretary of W. C. Holmes & Company, Limited, Huddersfield, Mr. A. J. M. HENSHAW, director and general sales manager of W. C. Holmes, and Mr. P. Croset, managing director of Holset Engineering Company, Limited, have been elected directors of B.H.D. Engineers, Limited.

Sir JAMES MCNEILL is to relinquish the managing directorship of John Brown & Company (Clydebank), Limited, at the end of this month, but will remain on the board of the parent company, John Brown & Company, Limited. He is succeeded as managing director by Mr. JOHN BROWN, at present deputy managing director at Clydebank.

Mr. JOHN BAIN, A.M.I.MECH.E., president of the London branch of the Institute of British Foundrymen, has recently returned from a visit to Argentine and Brazil. Whilst in the Argentine, he had an opportunity of visiting 13 foundries and manufacturers of foundry plant, and on his way home, he visited a malleable foundry in Brazil. He had about 4,000 miles of interior travel, making a total round trip of approximately 16,000 miles.



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And others want our moulder's tools
Ladles, hooks or prongs.
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There's none that can compare
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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

September 23, 1959

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2, 10-ton lots or over: Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.40 per cent. P, 6-ton lots or over, £23 5s. 0d., delivered Birmingham, £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d.; South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.: North Zone, £26 6s. 6d.; South Zone, £26 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent., 6-ton lots or over: N.-E. of England (local iron), £24 14s. 0d.; Scotland (Scotch iron), Zone S.1, £25 0s. 6d.; Sheffield, £26 2s. 6d.; Birmingham, £26 11s. 6d.; Wales (Welsh iron), £24 14s. 0d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire, in 6-ton lots or over.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £40 0s. 0d. to £42 10s. 0d., scale 15s. 0d. per unit, lumpy; 75 per cent. Si, £54 0s. 0d. to £57 10s. 0d., scale 15s. 0d. per unit, lumpy.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 10d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 12s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 15s. 6d. per lb. of W.

Ferro-chrome (6-ton lots and over, lumpy). —4/6 per cent. C, £77 0s. 0d. to £81 0s. 0d., basis 60 per cent., Cr, scale 26s. 0d. to 27s. 6d. per unit; over 6 per cent. C, £74 10s. 0d. to £77 10s. 0d., basis 60 per cent. Cr, scale 26s. 0d. to 27s. 6d. per unit; 2 per cent. C,* 1s. 7½d. to 1s. 10½d. per lb. Cr.; 1 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 0.15 per cent. C,* 1s. 9d. to 2s. 0d. per lb. Cr; 0.10 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.06 per cent. C,* 1s. 9¾d. to 2s. 0½d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £245 0s. 0d.; 96/98 per cent., £275 0s. 0d.

Ferro-columbium.—65/67 per cent., Cb + Ta, 19s. 9d. per lb., Cb + Ta.

Ferro-manganese (Standard).—78 per cent., £66 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., 100 tons & over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 6 to 35 tons, £33 15s. 6d.; hard (0.41 to 0.60 per cent. C), under 10 tons, £34 17s. 0d.; silico-manganese, under 10 tons. £43 16s. 6d.; free-cutting, under 10 tons, £36 14s. 6d. SIEMENS MARTIN ACID (under 10 tons): Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

Billets, Blooms, and Slabs for Forging and for Stamping (under 10 tons).—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

FINISHED STEEL

Heavy Plates and Sections (under 10 tons).—Ship plates, (N.-E. Coast), £42 2s. 0d.; boiler plates (N.-E Coast), £44 12s. 0d.; floor plates (N.-E. Coast), £43 11s. 0d.; angles (N.-E. Coast), £39 16s. 6d.; joists (N.-E. Coast), £39 12s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £67 4s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £68 10s. 0d.; nickel-chrome, £99 4s. 0d.; nickel-chrome-molybdenum, £111 17s. 0d., in lots of 5 tons to under 10 tons.

NON-FERROUS METALS

Copper.—Cash, £225 10s. 0d. to £225 15s. 0d.; three months, £226 0s. 0d. to £226 10s. 0d.; settlement, £225 15s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 2⅝d. per lb.; rods, 240s. 6d. per cwt. basis; 20 s.w.g., 275s. 0d. per cwt.

Tin.—Cash, £791 0s. 0d. to £791 10s. 0d.; three months, £790 10s. 0d. to £791 0s. 0d.; settlement, £791 10s. 0d.

Lead (Refined Pig).—Second half September, £69 7s. 6d. to £69 12s. 6d.; second half December, £70 17s. 6d. to £71 0s. 0d.

Zinc.—Second half September, £85 0s. 0d. to £85 5s. 0d.; second half December, £84 5s. 0d. to £84 10s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £119 15s. 0d.; rolled zinc (boiler plates), all English destinations, £117 10s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £101 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 10¾d. per lb.; sheets to 10 w.g., 196s. 0d. per cwt.; wire, 2s. 7⅝d.; rolled metal, 196s. 0d. per cwt.

Brass (Brazing).—BS1400, B3, £150; B6, £196.

Brass (High Tensile).—BS1400, HTB1, £181; HTB2, £198; HTF3, £210.

Gunmetal.—BS1400, LG2, £186; LG3, £198; G1, 1%, £246; G1, 1%, £235.

Phosphor Bronze.—BS1400, PB1 (AID released), £282; BS1400, 90/10/1, £263.

Leaded Phosphor Bronze.—BS1400, LPB1, £205.

Phosphor Bronze Strip, etc.—Strip, 282s. 6d. per cwt.; wire, 4s. 0d. per lb.; rods, 3s. 3¼d.; tubes, 3s. 3¼d.; chill cast bars: solids 3s. 3d.; cored 3s. 4d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 9½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 2½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 1½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £71 10s. 0d. to £72 0s. 0d. Nickel, £600 0s. 0d. Aluminium, ingots, £180 0s. 0d.; aluminium bronze (BS1400), AB1, £228; AB2, £240.

* Average 68–70 per cent.

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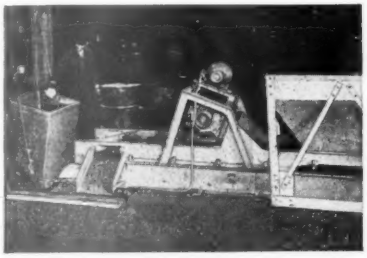
Conveying by vibration has proved both economical and efficient. At the same time the versatility of this method has impressed everyone who has witnessed its performance. Apart from conveying a very wide range of materials over long distances, many other functions can be performed whilst conveying. Among these are cooling, washing, drying, scalping, grading, and numerous others. It is this versatility that has led to the wide use of vibration in the Foundry Industry.



The Ajax Flexible Coupling Co. Inc., U.S.A. are recognised as being among the World leaders in Vibrating Equipment, and 'ACME' are their sole Licencees in this Country.

Photograph on left illustrates an AJAX VIBRATING CONVEYOR AND SCREEN *integrated into a sand conditioning system. Shakeout sand is fed to the* CONVEYOR *and oversize lumps are removed by passing the sand over a perforated plate. A magnetic Pulley at the discharge end removes metal particles.*

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ACME CHAMBERS, BRADFORD ST., WALSALL, STAFFS. *Tel.:* WALsall 5183-4 *and* 6793 *Grams:* ACKNIGHT, WALSALL
ACME HOUSE, SEAWARD STREET, GLASGOW, S.1 *Tel.: South* 2875-6 *Grams:* ACKNIGHT, GLASGOW
Works at: Hillington, Glasgow

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Ferro Silicon (12-14%)
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93, Hope Street.
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Notes from the Branches

South Africa

Dr. P. H. Riley, who has recently been appointed to the Foundry Sands Research Fellowship, was the lecturer at the August meeting of the South African branch of the Institute of British Foundrymen in Pharmacy House auditorium, Johannesburg. The president, Mr. K. H. Coombs, was in the chair and there were 60 members and guests present. The title of the lecture was "Foundry Sand Testing and Casting Defects."

In his opening remarks, the author assured his listeners that there was no intention to convey that there was a correlation between sand-testing and casting defects. Rather, the purpose of the paper was to deal with the types of defect which could be avoided by the modification of foundry-sand mixtures as a result of the correct interpretation of the results of sand testing. The active word in the foregoing statement being *interpretation*, for sand-testing as such was not a panacea for casting defects, and no amount of graphs, figures or results would save a casting from the scrap heap. The author then said that many foundries argue that the installation and operation of sand-testing equipment required specialized knowledge and was therefore expensive. The routine tests as described in the author's paper, however, were very simple—surely, the *most* expensive form of testing sand was to cast metal into it, he said!

General

In the first section of his paper, Dr. Riley stated that the tests to be recommended to any given foundry depended on the type of work on which that foundry was engaged, and the degree of its mechanization. The main body of the paper dealt with the common forms of testing used by foundrymen. Referring to mechanical analysis, it was pointed out that the surface definition of a casting can only be as good as that of its parent mould and thus, ideally, the magnified mould surface required to give a really flat casting surface should be a straight line. Only by the choice of the correct proportions of spherical particles of different sizes could this condition be approached, the appropriate test was classification of grain sizes by sieving. The sieve test was then described, but in conclusion a warning was given that this test on its own was not necessarily an indication that the sand was suitable for moulding.

Compaction

Compaction of sand was next dealt with, the author considering that tests for flowability were not to be recommended. The standard hardness test, although not proportional to mould density, was a good routine test where experience had shown that a good casting was obtained within certain hardness range, he said. Because of its simplicity, the green-strength was the most widely used in routine testing. The author remarked, however, that the information which it imparted was insufficient in itself, it must be used in conjunction with others. He said he considered that the moisture content was the most important property of a bonded sand for, if the clay and sand are fixed, as in many systems, upon it depends all the other properties. Methods of testing sands for moisture content were then described. Dr. Riley continued by saying that the usefulness of the shatter test should ensure that it finds routine application in the foundry. It had been suggested that this test measures either the ability of the sand to withstand deformation without failure, or the toughness of the material. From theoretical considerations it is known that both a brittle and a ductile material have low toughness values, and thus, as the water content in a sand increases, the shatter index should pass through a maximum. The maximum is in excess of the normal working moisture range in the case of clay-bonded sands, but can be demonstrated in synthetic resin-starch bonded core-sands.

Casting

Having discussed the moulding properties of sand with relation to the common tests for same, the author then dealt with the casting properties in so far as the material must be able to withstand the temperature of the metal, and should retain its moulded shape at least until solidification of the metal has taken place. It is also important, he said, that the air originally in the mould be completely replaced by metal. The following four properties were then enumerated: Refractoriness, permeability, expansion and dry-strength. In conclusion, Dr. Riley stated that the control of moulding materials in a foundry, by the intelligent interpretation of the more important sand tests, would lead to improvements in the finished article. A lively discussion ensued, and the vote of thanks was proposed by Mr. W. Brown.

Australia (Victoria)

In August, the Australia (Victoria) branch of the Institute of British Foundrymen held a joint meeting with the Australian Institute of Metals in the Metallurgy Theatre of the Royal Melbourne Technical College. The subject of "Heat-treatment of Various Castings" was dealt with in three papers, the first entitled "Steel Castings" was by Mr. A. M. Tennant (honorary member), chief metallurgist, Vickers Ruwolt Pty. Limited; the second, "Nodular Cast Iron" was presented by Mr. A. D. Main, B.MET.E., metallurgist, T. Main & Company, and the author of the last paper "Grey Cast Iron" was Mr. A. W. Silvester, chief metallurgist, Repco, Limited. The ensuing discussion covered such topics as comparison of grey cast-iron with steel, the importance of matrix composition, and stress relieving, annealing and hardening treatments.

Young People's Standards

"You are going to pass through a most exciting and exhilarating half-century before you slide gracefully into retirement about the year 2009," said Prof. H. C. Dent, Director of Sheffield University Institute of Further Education, recently. He was speaking to young apprentices and girls employed by Newton, Chambers & Company, Limited, Thorncliffe, near Sheffield, when he presented the firm's awards for further education.

Prof. Dent denied that standards of work, behaviour, and discipline were going down, but he warned that technical training alone did not produce the men and women of initiative, courage, and sympathy, the country needed. At present, he said, technical education was going through a process of gigantic reorganization and it was important that colleges should have the co-operation of firms in the task of training.

Presenting his report, Mr. R. S. Goodhind, personnel officer, said that as a result of the very large number of young people seeking employment, Newton, Chambers had had to restrict the area of recruitment, particularly for boys, very largely to the West Riding. An outstanding feature had been the increase in the standard, again particularly of boys, from secondary modern schools. It made selection more difficult, if more satisfying.

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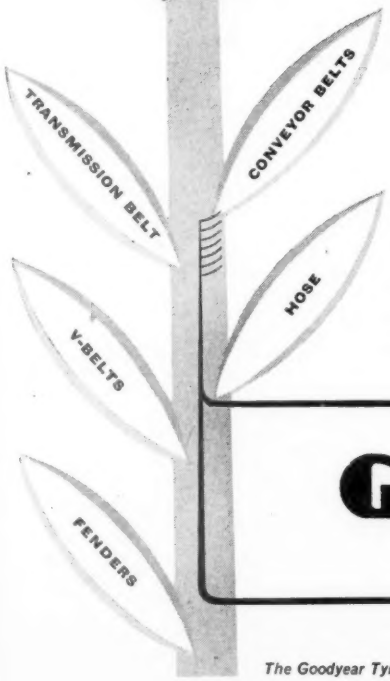

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GOODYEAR

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Company News

METAL AGENCIES COMPANY, LIMITED—A one-for-five scrip issue is announced.

UNIVERSAL ASBESTOS MANUFACTURING COMPANY, LIMITED—The group has acquired the entire share capital of Chancery Insulations, a private company engaged in the specialist application of "Seel" asbestos spray.

HEPWORTH IRON COMPANY, LIMITED—Arrangements have been made for a placing of 896,147 ordinary 5s. shares. The issued capital consists of 2,400,000 ordinary 5s. shares. It is expected that the shares will be available at 5s. 4½d.

RICHARD LLOYD, LIMITED, manufacturers of machine tool equipment, etc., of Birmingham—Interim dividend for 1959 is 4 per cent. on the capital increased by a two-for-five scrip issue. This compares with an equivalent of 3⅓ per cent.

C. A. PARSONS & COMPANY, LIMITED, engineers, turbine makers, etc., of Newcastle-upon-Tyne—The interim dividend is raised from 3⅛ per cent. to 4⅛ per cent. for 1959. The 1959 effective total of 8¼ per cent. included a special interim of ⅛ per cent. for the current year.

RIDGACRE FOUNDRY COMPANY, LIMITED—The company has been acquired by Triplex Foundry, Limited, Tipton (Staffs), for £47,000. Net assets at March 31, 1959, totalled £51,758, and the profit, before tax, for the year ended on that date amounted to £3,333, compared with £2,965 for 1957-58.

ARUSHA INDUSTRIES, LIMITED—The acceptance date of the company's offer for the ordinary shares in Webley & Scott, Limited, Birmingham engineers and machinists, has been extended to September 25. In a letter to 250 shareholders representing 184,109 shares in Webley & Scott, Franco-British & General Trust, Limited, urges rejection of the offer.

ASSOCIATED BRITISH ENGINEERING, LIMITED—It is not possible at present to foresee the time when ordinary dividends can be resumed, says the chairman, Mr. L. W. Robson, in his annual review. Group net loss for the year to March 31, 1959, was £99,251, against a profit of £30,277 for the previous year, when there was an interim dividend of 2½ per cent., but no final.

SOLAR INDUSTRIES, LIMITED (formerly the Aluminium Castings Company, Limited)—A final dividend of 10 per cent. makes a 15 per cent. total for the year ended March 31, 1959, against nil. Group trading profits improved from £170,691 to £287,769, after deducting losses of £71,685 (£88,705) of the Canadian companies. Group net profits of £121,169 compares with £45,291.

WILMOT-BREEDEN, LIMITED, manufacturers of automobile and domestic appliance accessories, etc., of Birmingham—The company has acquired a majority holding in France's largest manufacturers of locks, window regulators, and other components for motor vehicles, Autocoussin Dura, S.A. This company has a factory in Paris and a second plant at Evreux will be in full production by the end of 1960.

MUREX WELDING PROCESSES, LIMITED—The company has purchased the whole of the issued shares of Donald Ross & Partners, Limited, specialists in the design and manufacture of mechanical aids to production, of Crawley (Sussex). Donald Ross & Partners will continue to operate under the same name and the same management. The association will enable both companies to offer individually and jointly a first-class specialist service.

HAWKER SIDDELEY GROUP, LIMITED—Philip Hill, Higginson & Company, Limited, announces that its offer on behalf of the Hawker Siddeley Group to purchase for cash at 10s. 6d. a share all the issued share capital of Folland Aircraft, Limited, has been accepted by holders of 1,408,604 shares, equivalent to 90.87 per cent. of the total, and has, therefore, become unconditional. Philip Hill, Higginson & Company will continue to receive late acceptances.

ALUMINIUM CORPORATION, LIMITED—For the seven months ended July 31, 1959, the corporation is paying a dividend of 10 per cent. and a golden jubilee bonus of 5 per cent. As a result of the acquisition of the British Aluminium Company, Limited, by Tube Investments, Limited, the financial year of the group has been altered so as to end on July 31. For 1958 a dividend of 17½ per cent. was paid by the Aluminium Corporation. Net profits for the period amounted to £55,337, compared with £81,596 for 1958.

GEORGE KENT, LIMITED, industrial instrument and automatic control manufacturers, of Luton (Beds)—The directors announce that in the recent issue to ordinary stockholders of 540,000 10s. ordinary shares at 30s. per share, 529,766 shares, representing over 98 per cent. of the issue, were taken up under provisional allotment letters, leaving 10,234 shares available to meet over 550 applications for additional shares totalling 201,209 shares. The general basis of allotment of the additional shares was as follows:—Up to 15, in full; over 15, 15 shares. Preferential consideration was, however, given to applications received from the company's employees.

HALESOWEN STEEL COMPANY, LIMITED—Profits for the year to date exceed the comparable figures for last year, says the chairman, Mr. C. S. Burch. In view of this and in order to bring the issued capital more into line with asset values, it is proposed to make a one-for-five scrip issue. The interim dividend is repeated at 4 per cent. and in the absence of any unforeseen circumstances the board hopes to maintain the final dividend of 8 per cent. on the increased capital for 1959. An extra-ordinary meeting to pass the increase in the authorized capital to £315,000 and approve the capitalization of £40,000 from the general reserve will be called for October 16.

QUALCAST, LIMITED, light repetition engineers, lawn mower manufacturers, etc., of Derby—Group trading profits rose to £1,548,778 (£1,414,114) in the year ended June 30, 1959 and a final dividend of 15 per cent. is announced on the ordinary capital to be increased to £1,724,978 by the recently proposed one-for-10 scrip issue. This makes the total dividend equivalent to 26½ per cent. on the smaller capital, compared with 24 per cent. previously. In addition, there is a 3 per cent. (nil) capital distribution on the increased ordinary capital payable from profits, mainly derived from the sale of trade investments. After all charges, the net balance is £632,360 (£504,615).

Board Changes

ASSOCIATED BRITISH ENGINEERING, LIMITED—Mr. H. I. Wonfor has been appointed to the board and Mr. E. M. Benjamin has resigned his directorship.

RUSTON-BUCYRUS, LIMITED—Mr. Robert G. Allen, president of Bucyrus-Erie Company, of South Milwaukee, Wisconsin, USA, has been appointed a director and has been elected chairman of the board, to fill the vacancy caused by the resignation for health reasons of Mr. William L. Little.

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AP94

Pig-iron and Steel Production

Statistical Summary of May Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table 1 summarizes activities during recent months. Table 2 gives production of steel ingots and castings in May. Table 3, weekly average production of finished steel in April. Table 4 gives the production of pig-iron and ferro-alloys in May, and furnaces in blast. (All figures are weekly averages in thousands of tons.)

TABLE 1.—*Iron and Steel Price Index and General Summary of Pig-iron and Steel Production.*

Period.	B.o.T. Price Index, 1938 = 100.			Iron-ore output.	Imported ore used.	Coke sent to blast-furnaces.	Pig-iron, ferro-alloys prod.	Scrap used in steel prod.	Steel (incl. alloy).			
	Iron and steel.	Coal.	Basic materials excl. fuel[1]						Imports.[2]	Prod. ingots, castings.	Delivrs. finished steel.	Stocks.[3]
1957	328	488	537	325	303	270	275	220	14	417	322	1,444
1958	343	503	478	276	262	227	245	196	9	369	284	1,542
1959—Mar.[4]	342	502	473	276	217	195	221	195	7	363	266	1,479
Apl. ..	342	504	477	299	219	201	231	211	9	387	297	1,458
May ..	342	487	478	292	236	203	240	211	8	385	285	1,457

TABLE 2.—*Average Weekly Production of Steel Ingots and Castings in May, 1959.*

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derbys, Leics., Notts., Northants, Essex ..	—	4.1	15.2 (basic)	1.8	0.1	19.9	1.3	21.2
Lancs. (excl. N.W. Coast), Denbighs., Flints., Ches.	0.8	33.0	—	4.9	0.2	37.8	1.1	38.9
Yorks. (excl. N.E. Coast and Sheffield)								
Lincs.	—	44.0	—	—	0.1	44.0	0.1	44.1
North-East Coast	0.7	64.7	—	1.1	0.3	65.3	1.5	66.8
Scotland	1.4	31.4	—	2.1	0.1	33.2	1.8	35.0
Staffs., Shrops., Worcs., Warwicks. ..	—	17.2	—	3.8	0.7	20.1	1.6	21.7
S Wales and Monmouthshire	1.9	92.3	7.2 (basic)	0.7	0.1	101.9	0.3	102.2
S. effield (incl. small quantity in Manchester) ..	7.4	31.8	—	10.6	0.2	48.5	1.5	50.0
North-West Coast	—	0.8	3.3 (acid)	0.5	0.1	4.6	0.1	4.7
Total	12.2	319.3	25.7	25.5	1.9	375.3	9.3	384.6
April, 1959	11.5	322.2	25.3	26.2	2.1	377.4	9.9	387.3
May, 1958	14.8	317.1	23.7	21.2	2.2	368.5	10.5	379.0

TABLE 3.—*Deliveries of Non-alloy and Alloy Finished Steel.*

Product.	1957.	1958.	1958.	1959.	
			April.[4]	March.[4]	April.
Non-alloy steel:					
Ingots, blooms, billets and slabs[5]	5.0	4.6	5.1	4.1	6.0
Heavy rails ..	11.2	10.2	11.8	7.3	8.2
Sleepers	1.3	1.2	1.5	0.7	1.5
Fish and soleplates	0.8	0.7	0.9	0.3	0.5
Plates:					
(i) ⅜ in. and over	34.0	29.6	33.5	25.1	25.4
(ii) Under ⅜ in.	20.3	17.7	18.6	17.2	17.4
Other heavy prod.	53.0	41.8	54.7	35.5	39.9
Ferro-concrete bars	8.9	7.6	6.9	7.8	8.7
Wire rods	23.3	21.5	18.8	21.1	24.6
Arches, etc. ..	11.0	8.6	10.4	8.7	8.9
Other light sections	38.7	29.1	30.5	28.5	32.6
Bright steel bars ..	7.0	6.2	6.2	6.3	7.7
Hot-rolled strip ..	23.1	22.6	22.0	26.7	27.3
Cold-rolled strip ..	7.1	7.0	7.3	7.0	7.8
Sheets, incl. coated:					
(i) Hot-rolled ..	13.0	10.6	11.5	10.8	10.4
(ii) Cold-reduced	29.1	31.1	29.4	33.3	38.8
Tinplate:					
(i) Hot-dipped	11.3	8.4	9.0	6.4	7.7
(ii) Electrolytic	7.5	10.3	10.6	12.5	13.8
Blackplate ..	1.0	0.8	0.9	0.7	0.6
Tubes up to 16 in.	22.1	19.0	18.3	18.4	20.9
Tube, pipe fittings	0.5	0.4	0.3	0.4	0.4
Tyres, wheels, axles	5.1	4.5	5.0	3.0	3.0
Forgings (excl. drop)	3.1	2.6	2.8	2.0	2.4
Steel castings ..	4.6	4.2	4.3	3.7	3.9
Tool and magnet ..	0.3	0.2	0.2	0.2	0.2
Total	342.3	300.5	320.5	287.7	318.6
Alloy steel	17.8	16.1	16.1	17.0	19.1
Total deliveries from UK production[6] ..	360.1	316.6	336.6	304.7	337.7
Add: Imported finished steel ..	9.6	7.1	7.2	6.3	9.7
Deduct: Intra-industry conversion[7] ..	48.2	41.2	41.9	46.1	51.1
Total deliveries new material	321.5	282.5	301.9	264.9	296.3

TABLE 4.—*Production of Pig-iron and Ferro-alloys*

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derbys, Leics, Notts, Northants and Essex	19	—	24.5	15.8	1.4	—	41.7
Lancs (excl. N.W. Coast), Denbighs, Flints, and Ches ..	7	—	19.9	—	—	1.8	21.7
Yorks (excl. N.E. Coast and Sheffield)							
Lincs	8	—	41.9	—	—	—	41.9
North-East Coast	17	2.8	42.1	—	—	0.8	45.7
Scotland	6	0.6	13.6	0.5	—	—	14.7
Staffs, Shrops, Worcs, Warwicks	4	—	5.7	0.9	—	—	6.6
S. Wales and Mon	10	3.7	47.2	—	—	—	50.9
Sheffield	2	—	3.6	—	—	—	3.6
North-West Coast	7	11.9	—	0.1	—	1.7	13.7
Total ..	80	19.0	198.5	17.3	1.4	4.3	240.5
April, 1959 ..	79	20.4	189.3	18.5	0.2	2.9	231.3
May, 1958 ..	90	23.9	195.0	26.0	0.2	4.5	249.6

[1] Used in non-food manufacturing industries.
[2] Weekly average of calendar month.
[3] Stocks, mainly ingots and semi-finished, at the end of the year and months shown.
[4] Five weeks, all tables.
[5] Other than for conversion into any other form of finished steel listed.
[6] Includes finished steel produced in the UK from imported ingots and semi-finished steel.
[7] Material for conversion into other products also listed in this table.